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# ANNALS

OF

# SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY

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ANNALS OF SURGERY.

# THE RESULTS OF DOUBLE CASTRATION IN HYPERTROPHY OF THE PROSTATE.[1]

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I SHALL ask the indulgence of the Association, if in the paper I am about to read I seem to go a little beyond the exact limitation of the title. I have divided it into,—

(1) a Theoretical, (2) a Clinical, and, (3) an Experimental portion.

I shall consider in part first a theory of causation which, though I must admit it to be vague, has seemed to help me to an understanding both of the results of the operation and of some of the clinical features of the growths.

The second part contains a review of some illustrative cases; a summary of a considerable number (111 in all); and a consideration of the objections thus far urged against the operation and of its relative merits and future prospects.

In the third portion I have given the experimental and other evidence in regard to the value of,—(*a*) Unilateral castration; (*b*) Ligation of the vas; (*c*) Ligation of the spermatic and deferential arteries; (*d*) Ligation of the entire cord. Tables of the 111 cases and of the fatal cases are appended.

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[1] Read at the meeting of the American Surgical Association, New York, May 28, 1895; and at the meeting of the American Genito-Urinary Association, Niagara Falls, May 29, 1895.

## PART I.

When in 1893 I read a paper before this association on the "Surgery of the Hypertrophied Prostate," I went at some length into the theories of causation. That of Guyon, that the disease is only part of a constitutional condition peculiar to advancing years and characterized by arterial sclerosis, etc., and that of Harrison that the growth is compensatory in its character and secondary to certain bladder changes seem untenable in the light of the information we now have. It may be admitted at once that we can demonstrate nothing whatever as to the essential cause of senile enlargement of the prostate. There seems some reason to believe that it is favored by prolonged ungratified sexual excitement, but as there can be no doubt that it tends to bring about undue sexual excitability, it is obvious that the relationship of cause and effect can readily be transposed. The same remark applies to the observation of Mr. Buckston Browne, who thinks he has noticed enlargement of the prostate in an unusual proportion of cases among men who had contracted second marriages late in life. It is at least an open question whether such marriages are the cause or the effect of the hypertrophy.

The close relationship between the testicles and the accessory sexual glands—the prostate, Cowper's glands, and the seminal vesicles—naturally leads to speculation as to a possible connection of the overgrowth with testicular changes coming on with advancing years. The testicles, whose highest and most specialized function is to produce spermatozoa for the propagation of the species, seem, like the thyroid, to exert a wide-spread influence over general nutrition and development. This is also true of the ovaries. "In man, as in the rest of the vertebrate animals, the male and female organs in the original state of the germ are entirely the same, and the differences of the two sexes only gradually arise in the course of embryonic development (in man, in the ninth week of embryonic life), by one and the same gland developing, in the female as the ovary, and in the man as the testicle. Every change of the female ovary, therefore, has a no less important reaction upon the whole female organism than every change of the testicle has upon the male organism."[1] The removal of either testicles or ovaries in early life usually changes profoundly all the characteristics—physical and mental—of the individual. There is, however, abundant evidence[2] to show that the testicles may lose, or may never have had, the sperm-producing power and still possess the quality which enables them to hold the organism in its normal groove and to invest it with the full attributes of masculinity. When both testes fail in their descent they are incapable of producing spermatozoa, and in consequence the person is sterile. This has been shown by Hunter, Astley Cooper, Curling, Griffiths, and others, and is undoubtedly the rule, although there are occasional exceptions. In spite, however, of the imperfection of the organs, such a person acquires all the external bodily characteristics of the male, and is in all respects, except in the power of procreating, like an ordinary man.[3] It is not known whether this influence is exerted through a chemical product or not, but the fact that some indubitable effects are produced on the whole system by the injection of watery extracts of the testicles would seem to favor this idea. "The function of the testes is therefore clearly twofold,—viz., (1) to control and determine the development of the characteristics of the male sex, and (2) to produce spermatozoa for the reproduction of the species. These two functions are usually exercised together, but that the former may be exercised when the latter fails seems to indicate that the production of spermatozoa is the more specialized property and attained with more difficulty. In what manner is this sexual effect of the testes upon the body produced? Is it through the medium of the nervous system as an ordinary reflex, or is it through the medium of some substance produced by the seminal cells (whether they form spermatozoa or not) and absorbed into the system, which by influencing the nerve-centres or in some other way controls growth and nutrition? Brown-Séquard tried upon himself, when he was seventy-two years of age, the effect of the subcutaneous injection of a watery extract of the testes of a vigorous dog two or three years of age, and relates that after five daily injections he lost his feebleness, felt many years younger, and was capable of doing more work. The testicle extract has since been used in various diseased conditions, chiefly those associated with nervous debility, but with only temporary results. During the last few years a watery extract of the thyroid gland has been administered with signal success in myxœdema, in which disease the thyroid gland atrophies and ultimately disappears. The disease myxœdema arises from the want of the influence of some unknown substance, which the thyroid gland, as is supposed, elaborates upon the nutrition centres of the central nervous system. It may be that the testis in like manner elaborates, irrespectively of its spermatic secretion, some chemical substance, which by a similar influence not only controls the growth and development of the body at puberty, but maintains the manly characters then acquired throughout life."[1] Cabot has tried the injection of testiculin in mania following castration in one case with improvement of symptoms, whether *post hoc* or *propter hoc* cannot be determined. Whatever its mode of action, however, it is probable that the need for this occult property of the sexual glands would begin to disappear after their essential purpose had been subserved,—*i.e.*, after full adult life had been reached and the individual was cast in the mould intended by Nature. This need abrogated there would yet remain the function common to both sexes, that of producing cells endowed with the property of perpetuating the species. The testicle and the prostate would thus at this time have a closer physiological resemblance to the ovaries and uterus than at any other period of life. Both ovary and testicle would still possess the power of propagation, and with it a marked effect upon all the accessory sexual organs, while at the same time the necessity for a certain controlling influence would have been removed and larger opportunity afforded for aberration in the growth and structure of the tissues involved. This may especially be the case, as with the cessation of the necessity for the exercise of this function (or for the evolution of the hypothetical product in question) the activity of the testicle does not cease. The organ (that it may be able to perform the other half of its work,—the generation of spermatozoa) is still preserved from atrophy. Nothing in the little we know of the origin of the so-called benign growths in the body contradicts the theory that overgrowth of normal structures may be favored or hindered by changes in the nervous and vascular supply of the region. The disappearance of the necessity for a given product without the coincident disappearance of the vital energy which was expended in producing it might conceivably result in hypertrophy of organs intimately associated with those which were the source of supply.

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[1] Haeckel, The History of Creation, Vol. 1, p. 244.

[2] Curling, 4th ed., p. 14.

[3] Griffiths, The Lancet, March 30, 1895.

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[1] Griffiths, loc. cit.

The general law of correlation between the sexual organs and other parts of the body extends throughout the whole realm of organic life. "If one wishes to obtain an abundance of fruit from a garden plant, the growth of the leaves is curtailed by cutting off some of them. If, on the other hand, an ornamental plant with a luxuriance of large and beautiful leaves is desired, then the development of the blossoms and fruit is prevented by cutting off the flower buds."[1] This principle, called by Goethe that of "compensation of development," which is thus used practically to secure the increased growth of one system of organs at the cost of another, may apply equally to different organs of the same system. Griffiths[2] says, "The whole genital system is an apparatus the potentiality of which mainly depends upon the integrity of the testicles, one or both; they control the extent to which the remainder of the sexual apparatus grows, the growth of the vas deferens no less than that of the prostate and other accessory sexual glands. I make this statement because in observations upon castrated animals I have found that the testicle exerts such an influence upon the growth of the other parts of the sexual apparatus."

The theory of tumor formation, recently advanced by Roger Williams,[3] has a more or less direct bearing upon this question. He says that in the genesis of neoplasms, as in the genesis of other organic structures, we must take into consideration two factors,—the *cells* whence they originate and the *force* that regulates the cellular activities. He believes with Spencer that every component cell of the multicellular organisms has the inherent power of developing itself into the form of the parent organism; that the enormous reproductive powers of the somatic cells have not been fully realized by pathologists; and that these powers are only held or restrained in the normal individual by a "force" which regulates the growth and development of the tissues and organs in relation to each other and to the organism as a whole. He believes further that the essence of the neoplastic process is that certain cells of the affected part grow and multiply more rapidly than their congeners, and adds, "I explain this rejuvenescence as due to failure of the integrative force that normally restrains their activities within proper limits. Under these circumstances, whenever there is a sufficient supply of nutritive materials, capable of being utilized for growth by the cells of the parts, there a neoplasm will arise,—that is to say, the abnormally emancipated cells will there grow and multiply more or less independently, regardless of the requirements of the adjacent tissues, and of the organism as a whole."

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[1] Haeckel, op. cit., p. 245.

[2] Op. cit.

[3] Diseases of the Breast, p. 138.

If there is any truth in my theory, such a modification of the natural ovarian and testicular functions as I have suggested would, so far as the development of uterine and prostatic overgrowths was concerned, be equivalent to a failure of the general restraining force. It is not demonstrable and may be regarded as not reasonable, but I have thought that its provisional acceptance might serve as a step towards the understanding of the essential etiology of these tumors, which, on account of their enormous frequency and serious consequences, have a practical importance, that I hope may give even such metaphysical speculations as to their causation a certain amount of interest. The persistence of what might be called unexpended energy during the ovule- and sperm-producing life of the ovaries and testicles respectively, might thus offer a reasonable explanation of the overgrowths in question, while the final atrophy of the former organs would similarly be accompanied in many cases by such a withdrawal of nervous and vascular supply as to prevent the occurrence of hypertrophies or even to cause their disappearance if they had already formed. That this is the case as regards uterine fibromyomata is a fact which clinical experience abundantly demonstrates. I have endeavored to show[1] that there is reason for believing that it is equally true of prostatic overgrowth. Unfortunately, what may be called the accidental concomitants of the condition,—accidental in the sense of being due to anatomical propinquity,—the vesical and renal changes, usually cause death in those subjects whose advanced years might of themselves, through sexual failure, prove curative. An examination of Messer's tables, founded on a dissection of 100 prostates in men over sixty years of age, discloses one interesting fact in this connection. Assuming arbitrarily that eighty may be taken as the age at which, in the great majority of men, the sexual life is absolutely and finally ended, we find that among those subjects whose prostates weighed over six drachms, the percentage of octogenarians or their elders was only 22.8, while among those whose prostates weighed less than six drachms, many of them less than normal, the percentage was 35.3, more than half again as great.

This is not only confirmatory of Desnos's observations, that after a certain period of life the frequency of notable hypertrophy diminishes, but it suggests the possibility that in many of these cases physiological atrophy had already begun. The subjects were not selected from among patients, but just as they happened to come within reach of the investigator. The uncertainty as to the exact duration of sexual life in the male also weakens the force of the statement that the condition does not manifest itself until after the period of life when it should occur if it were truly homologous with the uterine growth. In addition, it may be said that there is accumulating evidence that prostatic hypertrophy begins much more frequently than was formerly supposed during middle life, and that the statistics on which we have been accustomed to rely, based on museum specimens and on the experience of surgeons to whom the patients apply only when distinct subjective symptoms have developed, are, to an extent, unreliable.[2]

[1] ANNALS OF SURGERY, August, 1893.

[2] ANNALS OF SURGERY, August, 1893.

In some of the cases which I shall presently summarize living spermatozoa could not be found in the testicles at the time of removal, and yet the effect upon the prostate was as marked as in most of the others. If the theory which I have just advanced is the correct one, such cases indicate the persistence, but perversion of part of the twofold function of the testes after the reproductive factor had vanished. If the assertion that ovulation and menstruation are more independent of each other than has hitherto been believed[1] be correct, we have a similar explanation of some of the anomalous cases of uterine fibroids which have remained, or, more rarely, developed after what was a menopause but possibly not a true climacteric.

It was the apparent analogy between the uterine and prostatic growths which led me to the investigation that resulted in my suggesting this operation to the profession. This analogy, as it is part of the present argument (Velpeau, Thompson, White), may be briefly restated as follows: The prostatic vesicle is the analogue of the sinus genitalis in the female,—the uterine and vaginal cavities; the structure of the prostate and that of the uterus are strikingly similar, and would be almost identical if the tubular glands found in the inner walls of the uterus were prolonged into its substance; the histology of the growths, from small encapsulated tumors, easily shelled out, or polypoid growths intimately connected with the uterus or prostate up to the enormous growths which far exceed the original bulk of the organ itself, are identical; or there may be in either case a general hypertrophic enlargement affecting the whole organ; lastly, these disturbances occur at about the same time in the sexual life of the two sexes,—that is, during the latter half of the reproductive period. This ends sooner in the female than in the male, and accordingly we find the growths appearing in the former at a somewhat earlier age.

This analogy is said by the embryologists to be without foundation as regards any true homology between the prostate and the uterus. The clinical resemblances between the two forms of overgrowth are, however, none the less striking, and it may now be said that the results of castration in such cases are equally similar and remarkable in both sexes. I am quite willing to accept Moullin's way of putting it: "Enlargement of the prostate bears the same relation to the testes that fibroid disease of the uterus does to the ovaries. But the fact that they bear the same relation to two different organs is no proof that they bear any relation to each other." I must add, however, that even although the prostate is not the absolute homologue of the uterus, as it contains and encircles the cavity which is said to be—*i.e.*, the utricle or "prostatic vesicle,"—the relationship between the two is remarkably close. So, too, although the uterine growths begin as fibromyomata and the prostatic as adenomata or adeno-fibromata, the difference merely corresponds with the differences in structure of the two organs, the prostate containing normally more glandular tissue than the uterus.

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[1] American Text-Book of Gynæcology, p. 95.

Pitfield Mitchell[1] believes the frequency of fibrous, epithelial, and fatty growths, as compared with growths of more highly specialized tissues, to be due to "that inverse relation between reproduction and specialization seen throughout the whole organic kingdom. It has been established as one of the laws of reproduction that whatever energy is used up for increase of mass, for increase of structure, and for functional work, is so much deducted from the energy that might be available for productive processes. So that the relative scarcity of myoma and neuroma is in consonance with the fact that reproductive power tends to diminish as specialization or structural complexity increases. The indications of this law both in the animal and vegetable worlds are unmistakable, nevertheless the evidence of it is almost inextricably entangled as the generalization applies to neoplasia. For, taking the organism as a whole, we see in the case of myoma that this is an uncommon tumour, whether of striated or non-striated muscle, yet it is far from being so in the uterus. Here we may be confident the exception is due to exceptional circumstances."

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[1] The Philosophy of Tumour Disease, London, 1890.

He might have added as a corollary that when energy of any sort is set free, as it were, it must tend to favor the "increase of mass" of which he speaks, and possibly the reversion of the tissues to the mode of genesis of unicellular organisms for which he is arguing as a cause of all tumors. "The generation of a tumour must be regarded as a reversion to an ancestral mode of reproduction; as the resumption of a habit proper to the remotest ancestors of the metazoa, the protozoa. It is a seeding of the natural plastids of the body. As reproduction for the entire individual is effected by organs—ovaries and testes—specialized for the purpose, reproduction for the individual units is accomplished by the units themselves."

The relation between the reproductive function itself and the growth of the individual is a marked one at the very beginning of organic life. When the continued existence of the whole organism is endangered, its entire energy seems to be devoted to securing the reproduction of the species. This is seen in many of the diatoms, infusoria, moulds, algæ, and lowest forms of bacilli. In the latter it has the most widespread influence upon surgical practice, as the expiring effort of the microscopic organism whose life threatens the life of our patients is to produce spores which have still more obstinate vitality. "This primordial trait has left its mark even upon the highest plants and animals. If the flow of sap in still growing trees is diminished by ringing or other injurious action, they will cease to grow and begin to flower. In the shape of buds reproductive centres may be induced in bulbs by cutting out the embryo. The aphis, kept in an artificial summer, may for years be made to reproduce by parthenogenesis, but with want of food or a low temperature sexual genesis will set in. Similarly with the common hydra. A vestige of the trait probably remains even in man where death is often accompanied by the ejection of seminal fluid."[1]

All this goes to show the direct relationship which exists in all living things between processes of growth and the organs concerned in reproduction, and makes it more reasonable to imagine that a diversion of any of the powers of those organs might result in grave modifications of those portions of the body most intimately associated with them. Even if it is thought that according to Mitchell's hypothesis the true explanation of the genesis of the uterine and prostatic growths lies in the gradual decline in the physiological life of the sexual organs which begins after middle age,[1] the continued growth and increase of these new formations might well be encouraged and stimulated by the persistence of energies which have survived their usefulness.[2]

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[1] Mitchell, op. cit., p. 11.

There must be some explanation of the differences in the liability of different organs to new growths. "The most striking contrasts are met with. On one hand, primary tumours of the heart are scarcely known, and on the other, myomas of the uterus are so common that one woman in every ten is said to be afflicted," and the frequency of prostatic overgrowths is even greater. It is not in these instances, as Mitchell supposes it to be in some, the impending cessation of tissue vitality as a whole, permitting the reversion of cells to primitive conditions of growth and multiplication, for, as we have seen,[3] the evidence is demonstrative as to the uterine growths, and almost equally so as to the prostatic, that after a certain period of life is reached they cease to make their appearance.

He says himself[4] that innocent tumors are the products of centres of growths set free by tissue whose reserve of vitality is relatively large, and explains in this manner the fact that "mature" (benign) growths are found at an earlier period of life than the "immature" (embryonic, malignant). An excess of "vitality" or of energy which has become purposeless, as I have suggested, would therefore seem to favor the occurrence of just such growths as those we are considering, and the withdrawal of the source of that energy (by oöphorectomy or castration) might be expected on theoretic grounds alone to be followed by the retrograde and atrophic changes which after middle life are beginning everywhere throughout the organism, and would be relatively more rapid in organs or tissues which had become functionless. Clinical facts appear to indicate that both the uterine and the prostatic growths have some relation to sexual activity. Winckel, Roehrig, Emmet, and others[1] have shown that uterine myomata (like mammary adenomata) are favored by marriage and fecundity. I have already alluded to the prevalent but unproved view that prostatic enlargement is related to sexual excess. It may be that in these facts there will be found further support to the theory I have advanced, as two separate but allied functions of a single gland are probably not readily dissociated, and activity of the reproductive and still purposeful function might cause or favor coincident but harmful activity of its fellow.

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[1] It would appear that when the contained energies of the cell are insufficient to maintain the balanced functious needful for individual life, the remnant of contained energies, being equal to the less costly function of reproduction, is consumed in a last effort to continue the species. So that a necessary condition of histogenic dissolution is a more or less gradual decline of life in the individual cell.—Mitchell, op. cit., p. 14.

[2] Thus, the most general and invariable condition of tumour-genesis is the dissolution of pre-existing tissue accompanied by the birth of tissue; not the condition, be it most carefully observed, of tumour-growth. The genesis of a tumour is one thing, and the growth or increase of its mass is another. The processes are distinct in character and different, often quite opposite, as to their conditions.—Mitchell, op. cit., p. 15.

[3] ANNALS OF SURGERY, August, 1893.

[4] Op. cit., p. 43.

I may seem to hold to this view (including the apparent analogy between the uterine and prostatic growths) with unwarranted persistence, and I do not desire to undervalue the arguments against it; but it must be remembered that we have no other which at all explains either the causation of the growths, their spontaneous disappearance (or failure to appear) at a certain time of life or their cure by castration. So far as the theory of analogy is concerned, I said long ago that even if it were true it could scarcely be said to be a full explanation of the occurrence of the prostatic growths, but by allying them to a well-known group of tumors would certainly bring us a step nearer to their comprehension. Its provisional acceptance with this statement, and irrespective of the additional views as to causation which I have just advanced, is not therefore to be regarded as concealing our ignorance, as Mr. Moullin[2] fears, but gives us a sort of working hypothesis which has certainly thus far stood the test of practical application.

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[1] Quoted by Mitchell, op. cit., p. 169.

[2] Op. cit., p. 39.

## PART II.

The clinical evidence of the truth of the statement that the hypothesis has stood the test of practical application will readily be found in the history of one hundred and eleven cases which I submit in tabular form for publication with this paper. It will, of course, be impossible for me to read them all to you in detail, but there are certain general facts which a few of them will serve to illustrate. I will take for this purpose three cases, each of which was seen by several observers and in regard to which I have fairly complete details.

CASE CVII.—The patient, aged sixty years, weight about 135 pounds, a carpenter by trade, was admitted to the University Hospital November 16, 1894. He was much broken down by long-continued suffering, but was exceptionally intelligent for a hospital patient. He had begun to have symptoms of prostatic obstruction eighteen months previously. He had undergone various forms of internal treatment in spite of which he was urinating hourly, and had used the catheter (with increasing frequency) for years. His distress had become so great that he came for advice and for a rest in the hospital. He was examined by me, by several assistants, and by two members of the class. His prostate was estimated to be of the size of a small orange. The finger could not reach the upper border. The lateral enlargement was very marked, the borders of the gland nearly touching the ischiatic rami. It was moderately firm, and slightly elastic upon pressure. A soft catheter went in with a little difficulty. Urine began to flow when the eye was about ten inches from the meatus. The amount of residual urine averaged six ounces. He was using a catheter from four to eight times daily and urinating, or attempting to urinate, from twelve to twenty-five times—occasionally oftener—in the twenty-four hours. The urine contained blood and pus, but no casts. It was stinking and loaded with mucus.

Castration was advised but was refused. He was admitted to the ward, the bladder was irrigated daily, and the urine sterilized as far as possible by the administration of salol and boric acid; recumbency with the pelvis slightly elevated was maintained and the diet carefully regulated, milk being given chiefly. He got some relief from these measures, but there was no change in the quantity of residual urine. He was taught the proper use of the catheter and instructed how to keep it sterile, and left the hospital.

On December 5 he returned and said that he was so much worse that he was ready for operation. This was performed December 12 in the presence of the class. Ether was used ; the time of operation, including stitches, was three minutes.

Improvement in urination became manifest in the first twenty-four hours after operation. In a week the patient emptied the bladder easily and painlessly ; the urine was clear ; the frequency of urination had decreased to five or six times daily. The residual urine as reported by Dr. Small, the resident physician, had diminished to half a fluid ounce, and on December 26, but one fluid drachm remained after urination. This was verified by Drs. Martin and Wood. He was examined (before the class) five days after the operation and the prostate was found to be merely a flattened fibrous mass, the upper border easily reached, the lateral borders shading off insensibly so that its limits in those directions were difficult to determine. The bulging into the rectum, previously so unmistakable, had disappeared. The prostate itself might almost be said to have done so. A catheter inserted eight and a quarter inches drew a few drops of urine. The patient described to the class the change in the character of his urination and said that he then felt as he did "when he was a boy in the fields."

He remained as a helper in the surgical wards for four months. During this time he had on three occasions a little increased frequency of urination, each time associated with digestive disturbances. He left the hospital apparently entirely cured.

Dr. R. H. Fitz, of Boston, examined the prostate per rectum a short time before the patient's discharge, and stated that "it was so soft and so small that its outlines were indeterminate. The prostate and the wall of the bladder felt very much alike."

I have operated upon other cases which are included in the table and which are equally striking, but I prefer to select for the remaining two examples cases by other operators in other cities.

CASE III.—Dr. Beach, of Boston, kindly sends me the following interesting notes which I transcribe exactly as he wrote them :

"Patient, seventy years of age; tuberculous family history. His habits had been good. Not addicted to the use of tobacco or alcohol. No history of venereal disease. Had always enjoyed good health until ten years ago, when he was obliged to pass his urine frequently and in small quantities. He had never been catheterized. Entered the hospital November 13 with his bladder much distended and his urine continually dribbling from him. By the rectum the prostate gland was found to be much and uniformly enlarged, extending nearly to the ischium laterally and as far as the finger could reach posteriorly. In front it projected at least an inch above the superior line of the pubes. The tunica vaginalis of the left side was moderately distended by a hydrocele. Upon examination of the urine it proved to be free from sugar, specific gravity 1020, containing a trace of albumen and a large quantity of pus and bladder epithelium. The urine was drawn by a soft rubber catheter carefully sterilized twice daily. Meantime there was some dribbling. Mentally, he had been failing for a number of weeks. He remained in bed all of the time, barely rousing enough to open his eyes when spoken to sharply, or reminded of the necessity for passing his urine, and then would lapse again into the same dull and listless condition. The drowsiness slowly increased to deep stupor. By the 23d he ceased to pass any urine and the quantity drawn by catheter each time became less. December 5, catheter entered with much difficulty on account of the obstructing prostate gland. December 6, no urine passed for twenty-four hours. It had become impossible to pass either a silver gum elastic, or a soft rubber catheter (this including various sizes of each and the probe pointed and Mercier tipped elastic instrument). Suprapubic puncture and withdrawal by aspirator of the bladder contents. The hydrocele has increased to three times its size upon entrance.

December 7. Same condition mentally and physically. Aspiration of bladder and an unsuccessful attempt made to enter by catheter afterwards. This was repeated on the 8th, 9th, and 10th, when after the aspiration it was possible to enter a soft rubber instrument and to tie it in place. As soon as the patient was left for a few moments he pulled it out. The patient was examined by Dr. J. C. Warren, who concurred with Dr. Beach upon the condition of the patient and the expediency of an attempt at relief by castration.

December 11. Castration. Afterwards the catheter was easily introduced and bladder emptied. 13th. No difficulty in catheterization since the operation. Bladder washed out twice daily. 14th.

Mental condition improving. A little dribbling of urine between the times for catheterization. 20th. Has improved steadily and to-day passed three ounces of urine without a catheter. 23d. Prostate examined carefully by those who had examined it before operation and found to be at least one-third in volume. It no longer projects above the pubes. 27th. Up to-day for the first time.

January 2. Improvement continues. Passed several ounces of urine without catheter. 8th. Patient passed catheter to-day without assistance, later eight ounces of urine without assistance. Has walked a few steps. Is clear and intelligent. 9th. During the past twenty-four hours has passed all of his urine without catheter. Wound healed. There has been as much improvement mentally as physically.

The third case which I have selected was reported in the *Medical Record* for April 20, 1895. I copy it as described by Dr. Howard Lilienthal, the operator. He remarks that the case was one which had been carefully watched, both before and after operation, by at least three observers who may be considered competent. There was no lack of attempt at palliation by the usual methods before resort to the castration.

CASE LIII.—M. M., a private patient in Mount Sinai Hospital (New York), in Dr. Gerster's service, was fifty-six years of age, and the father of a family. He was a merchant by occupation and lived in one of the Southern States. For about ten years he had been troubled with frequent micturition, with occasional attacks of vesical tenesmus, and with a gradual increase in the severity of his symptoms. About three years before coming to the hospital he had been catheterized for an attack of retention, but the exacerbation was of short duration.

Still from this time he had to be catheterized with gradually increasing frequency until, on admission to Mount Sinai, he was in constant pain and felt an urgent desire to urinate at least once an hour during the night. By day his condition was much worse, the attempts at emptying the bladder occurring about every five to fifteen minutes. His urine was alkaline, and there was a severe cystitis, with great quantities of pus and bloody mucus. A full-sized sound entered the bladder without difficulty. Dr. Gerster examined the prostate by rectum, and found it enlarged to about three times the normal size, but the cystoscope showed a well-marked middle lobe, which was thought to be responsible for the trouble in evacuating the bladder. For six weeks the patient was treated by catheterization, washings of the bladder, diuretics, oil of winter-green, and other internal antiseptics, but without improvement. Indeed, the man grew constantly worse. He was now emaciated, was thoroughly exhausted, and in a truly desperate condition. Dr. Gerster had proposed castration, and the patient had refused. The service now changed and I came on duty. At my first examination of the prostate by rectum I found the body about as big as a good-sized egg, not particularly tender to touch, but very firm and resisting. I made no cystoscopic examination, but accepted the positive observation of Dr. Gerster. When castration was again proposed the patient had become so hopeless that he decided to take his chances with the operation. At my request Dr. Fluhrer saw Mr. M. and examined him. He also diagnosed the case as one of enlarged prostate, and on learning that the treatment above outlined had been followed by no improvement whatever in six weeks he agreed with me as to the advisability of castration.

On February 9, under chloroform anæsthesia, I removed both testicles, which were nearly normal. There were signs of very slight bilateral epididymitis. The wounds were closed without drainage and the patient was out of bed in six days. The patient was catheterized every six hours, and his bladder was washed twice daily. For the first twenty-four hours there was a slight remission of symptoms, but on the third day he was almost as bad as ever. From the fifth day there was, however, steady and miraculously rapid improvement. Before the operation and immediately after, he could urinate only by drops, and there was always four to six ounces of residual urine. If he had allowed his bladder to become distended, practically all the urine was "residual," so that frequently at such times, after the man had exhausted himself trying to pass his water, ten ounces were withdrawn by catheter. The first improvement noted was that the patient could pass a stream. The residual urine rapidly diminished, the cystitis vanished, and in four weeks I presented him at a meeting of the Genito-Urinary Section of the New York Academy of Medicine. At that time he could hold his urine two hours at a time without discomfort, he passed a moderately powerful and full stream, and best of all there was but one ounce of residual urine. The urine still contained some pus but no mucus. It was acid and of the normal color. The man had gained many pounds in weight and enjoyed life. He could go to the theatre and could make the journey to Brooklyn, where he had relatives, without suffering by the way. It is needless to say that he is most grateful for what has been done for him. He does not for an instant mourn the loss of his testicles.

No cystoscopic examination was made after the operation, but by the rectum the prostate, though still enlarged, is only about half the size it was before and feels flaccid.

Both Dr. Gerster and Dr. Fluhrer have seen Mr. M. since his recovery, and express themselves as thoroughly convinced of the efficacy of the operation in this case.

A few days ago the patient returned to his home. Before leaving he again came to thank me and to say that catheterization was no longer necessary, the amount of residual urine being so small. I still advised the use of the instrument, however, once in two days, until there should be no residual urine.

I have chosen these three cases because they appear to me to bring up all the points which have thus far been in dispute as to the cases reported as "successful." The critics of the operation have said (*a*) that they still regarded it as a physiological experiment; (*b*) that the reported cases lacked detail and did not prove that the same results would not be obtained by rest in bed, careful catheterization, regulated diet, etc.; (*c*) that the subsidence of the symptoms and of the bulk of the gland, as reported, was too rapid to be due to atrophy, but must be owing to the disappearance of congestion and œdema; (*d*) that at any rate a true hyperplasia could not disappear in so short a time as has been reported; (*e*) that the estimates, both of the size of the hypertrophied gland and of its reduction in size, were inaccurately expressed; (*f*) that it was unreasonable to suppose that a long-standing cystitis would vanish even if the prostate did shrink; (*g*) that a vesical calculus in a post-prostatic pouch might be overlooked and only discovered later; and (*h*) that the cases had not been observed for a sufficient length of time to make the results reliable. I shall try to reply briefly to these assertions, basing my statements chiefly on the facts contained in the table.

(1) It seems to me that even a few such cases as those I

have described should remove the operation from the region of experiment to that of practical surgery, and show that it is at least as scientific and as certain in results as many of our accepted operative procedures. Of 102 cases contained in the table in which the condition of the prostate is noted, 65 or 63.7 per cent. are reported as showing some distinct decrease in size, while in twenty-four additional cases, eighty-nine in all (87 per cent.), the improvement in other symptoms renders the conclusion justifiable that the prostate had become smaller. In two cases autopsies have been made which demonstrate the exact nature of this shrinkage, and show that it is due to the same sort of atrophy, first of the glandular elements and then of the stroma, that I reported two years ago, as the invariable result in dogs. In one of these cases (No. 104, table) I confess I did the operation with scarcely a shred of hope for a cure. The patient was a broken-down hospital wreck, eighty-two years of age, with a very large prostate, and with absolute retention; catheterism was impossible, and the urine was loaded with albumen and casts; he was profoundly adynamic and alternated between uræmic stupor and delirium. I did the operation practically without ether and in three and a half minutes. He died comatose on the evening of the second day. It was thought by all those who examined him per rectum that the prostate was already smaller. But the microscopic report is conclusive as to the beginning of changes which are now well recognized as preliminary to full atrophy.

The report says:

" *Microscopical Examination.*—The stroma of the gland shows beginning proliferation of the connective tissue cells, but especially of the muscle-cells.

" The acini tubules are also becoming filled with proliferated columnar cells, and here and there some fine granular matter may be seen in the tubules; some of the cells appear to contain fine granules which have not taken the stain, evidently fat. The changes are typical of beginning atrophy."

In case No. 8 (table), in which the patient died of popliteal thrombosis and gangrene, eighteen days after double castration, the same changes, further advanced, were noted by Mr. Joseph Griffiths, F.R.C.S., Hunterian Professor in the Royal College of Surgeons, England. He describes in detail and figures[1] the microscopical sections, summing up as follows: "In short, the cell elements first proliferate, and ultimately disappear, leaving a comparatively small amount of fibrous connective tissue in their place. . . . The gland, whether enlarged or normal, undergoes certain degenerative changes after removal of the testicles which lead to its conversion into a small, tough, and fibrous mass in which there are only remains of the glandular tubules and ducts."

I have here the sections from my own case for examination by any of the Fellows who may desire to look at them. It is obvious that this, with other evidence, has been convincing to some members of the profession at least, as Sir Joseph Lister feels warranted in speaking of the operation as "a valuable addition to our art;" Fenwick in stating "that there is no doubt that slow shrinkage of the prostatic tissue in many of the forms of senile enlarged prostate ensues upon double castration;" Moullin in writing, "Removal of the testes is followed in a large proportion of cases, if not in all, by complete and rapid absorption of the enlarged prostate. This has been proved conclusively. The gland entirely disappears; nothing is left but a little fibrous mass;" and Cabot, in saying that, "the effect of castration in reducing the size of the chronically hypertrophied prostate is undoubted. Enough cases have been reported to show that."

(2) There will be found also in the table, in addition to those I have detailed, many cases which had been previously treated by various palliative measures, including, of course, rest in bed, catheterism, vesical irrigation, etc. The statement that the reported improvement could have been brought about by these means rather than by operation, seems to me in the face of the evidence scarcely worthy of further attention. The palliative treatment of prostatic hypertrophy is now understood by every general practitioner, and I frequently find in cases which I see

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[1] British Medical Journal, March 16, 1895.

in consultation that every possible care has been taken and the best judgment shown in the use of the catheter, the regulation of diet, the hygiene of the patient, etc. It is inconceivable that many of the operators in these cases should have overlooked such obvious preliminary measures. To be sure, their employment is specially mentioned in only a minority of the cases, but the omission was, I feel sure, a mistake of the writers, not of the surgeons.

(3) The assertion that the subsidence of symptoms has been due to the disappearance of congestion and œdema is largely negatived by the facts already given,—viz., the previous failure of palliative measures; and the pathological evidence of actual atrophy. Certain facts which seem to afford an explanation of the rapidity of the improvement in many cases, which as Lister has said, is "as remarkable as it is satisfactory," ought to be mentioned. All the varieties of enlargement have the same histological structure, but it is interesting to note the following observations, which seem to have a definite relation to one another. Sir Henry Thompson long ago[1] called attention to the fact that the posterior part of the so-called "median lobe" ("median portion," "prostatic commissure," etc.), contains a larger proportion of glandular structure than most other parts of the organ. This is demonstrated microscopically. It has been confirmed by others. Owing to its anatomical position the variety of hypertrophy, which affects this region, is of chief pathological importance. Watson has found it present in twenty-seven out of thirty cases examined by him. Nearly all the varieties of enlargement are probably originally adenomatous, but such growths would naturally begin where glandular tissue was most abundant. Griffiths[2] and Kirby[3] have shown that after castration it is the glandular tissue which first atrophies and disappears, and that this atrophy begins within a few days.

A consideration of these circumstances seems to make the rapidity with which favorable changes, such as ability to urinate

[1] Diseases of the Prostate.

[2] British Medical Journal, March 16, p. 579.

[3] ANNALS OF SURGERY, August, 1893.

(66 per cent.); ease of catheterism (about 75 per cent.), etc., have occurred in some of the cases more readily understood. A very little diminution in a growth largely adenomatous and occupying this particular region would, undoubtedly, be at once attended by a noticeable amelioration of obstructive symptoms.

(4) As to the disappearance of the hyperplasia, it must be remembered that the stroma consists largely of unstriped muscular fibres. Griffiths[1] has shown that "the intrinsic muscle-fibres of the prostate are subservient in function to the glandular tubules, and that in the developing prostate the muscle could be seen running in fine bundles in close relation to the tubules, and in such a manner as to be capable of exerting compression upon them; and also that after castration in the animals before mentioned (dog, cat, etc.) and in man, the prostate, after the lapse of a year or more, becomes transformed into a mass of fibrous connective tissue, which contains the remains of the once active gland tubules and a small number of atrophied muscle fibres scattered here and there. The complicated and much branched prostatic tubules, together with the non-striped muscle which forms a pronounced constituent of the normal prostate, have disappeared almost entirely, leaving, however, some remnants both of the gland tubules lined by epithelium, which has lost its glandular or secretory function, and of the non-striped muscle fibres."

Moullin says,[2] "the stroma of the prostate, like the glandular tissue it supports, belongs to the sexual organs. It has to do solely with the discharge of the prostatic fluid, and, as Dr. Griffiths[3] has shown, its development varies with that of the sexual organs. After castration it wastes as rapidly as the gland tissue." These facts would seem to explain satisfactorily the practical disappearance of the bulk of the gland, which has been said for *a priori* reasons to be impossible.

(5) As to the lack of accuracy in the estimation of the original size of the gland, and therefore in the statements regard-

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[1] Journal of Anatomy and Physiology, Vols. XXIII and XXIV.

[2] Op. cit., pp. 7 and 8.

[3] Loc. cit.

ing the exact degree of reduction in bulk, it must, of course, be admitted that precise measurements are both desirable and difficult. But while it is not easy to express the dimensions of the enlarged prostate in figures, there is no trouble by combined instrumental and rectal examinations in making a close estimate and drawing a fair comparison with some well-known object like a "walnut," a "lemon," an "orange," or a "base-ball," all of which terms are used by the gentlemen reporting cases, and all of which convey a reasonably exact idea of bulk to the average mind. As to the change in size, almost any operator has enough of the *tactus eruditus* to know whether or not a given body has shrunken one-half or one-third, or has decreased from the size of a lemon to that of a filbert.

(6) The disappearance in fifty-two cases (about 52 per cent. exclusive of Moullin's ten cases of which I have no details) of a previously intractable cystitis has certainly been a surprising phenomenon. But, after all, it is in accord with certain well-known facts. The prostatic plexus of veins receives nearly all the return blood from the bladder. Congestion of the former plexus is one of the most common and invariable phenomena associated with enlargement of the prostate. The veins attain a relatively enormous size, their valves disappear, and the backward pressure inevitably produces congestion and swelling of the vesical mucosa.

Septic infection of a healthy mucous membrane by the pyogenic microbes of acute or chronic cystitis is not possible, as Guyon, Albarran, and others have shown, even though such bacteria are present in the urine. When, however, the vesical mucous membrane is congested in consequence of obstruction to venous return and by distention of the viscus and frequently recurring contractions of the detrusor muscles, it offers but slight resistance to the microbic invasion. The pyogenic microbes are generally carried to the bladder by dirty instruments, or, if these are rendered sterile, through failure to cleanse the anterior urethra before the instrument is introduced into the bladder. Often cystitis develops independently of the use of instruments, probably as a result of infection conveyed by way of the urethral mucous membrane. The pathogenic microbes usually found are the bacillus coli communis and the staphylococcus pyogenes aureus. These cause vesical lesion either by direct action or indirectly through their ptomaines, and acting upon the urea produce ammoniacal decomposition. The ammoniacal urine in its turn acts as a powerful irritant to the bladder-walls, but is the effect, not the cause, of the cystitis.

Now, if the backward pressure is suddenly relieved and the vessels have an opportunity to regain their normal calibre and the bladder to empty itself more readily and more completely, it does not seem so unreasonable to suppose that microbic multiplication would cease; healthy epithelium with normal resistant powers would prevent further infection; the urine could be voided before its urea had undergone decomposition; its normal acidity would thus be re-established, and a virtual cure of the cystitis be effected.

According to Keyes,[1] "Fels and Ritter, by inoculating the bladders of dogs, produced ammoniacal urine and cystitis, but only on condition of ligating the urethra. Upon loosening this ligature the bladder promptly resumed its condition of health." The shrinkage of the prostate seems to be the "loosening of the ligature" in many of these cases. The subsidence of the tenesmus, which is often so severe as to produce lesions of the mucous membrane at the neck of the bladder, and the avoidance of similar lesions, often caused by even the most careful use of the catheter, are, of course, important factors in bringing about a disappearance of the cystitis.

(7) The lessening in the length of the urethra cannot possibly be, as has been suggested, merely the effect of relieving an overfull bladder, as Finger[2] has shown that on account of the inclusion of the pars prostatica in the bladder the urethra is considerably shorter when the bladder is full than when it is empty, a fact which he has demonstrated experimentally. "If, in an individual who as yet experiences no desire to urinate, an elastic catheter is introduced into the urethra until the first drops of urine begin to flow, and then the length of the por-

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[1] American Journal of the Medical Sciences, June, 1894.

[2] Gonorrhœa and its Complications, 1894, p. 34.

tion of the catheter situated within the urethra is measured; and if the same procedure is repeated in this individual when the bladder is full and the desire to micturate already present, it will always be found that in the latter case the catheter needs to be inserted two to three centimetres less deeply before the urine begins to flow,—in other words, the urethra is so much shorter when the bladder is full. Repeated experiments, which I performed, as a matter of course, upon healthy individuals, showed that the length of the portion of the catheter when the bladder was moderately full and the desire to urinate absent, was eighteen to twenty-one centimetres; when the bladder was very full and the desire to urinate pronounced, the length was only sixteen to nineteen centimetres." Now, as a rule, the measurements in these cases of castration have been made originally with the bladder more or less distended and later with the bladder nearly or quite empty, so that the reported improvement is probably understated rather than exaggerated. If the atrophy of the prostate is once admitted, however, the change in the urethra requires no further explanation.

(8) The return of power in the bladder has been in some cases (66 per cent.) as surprising as the disappearance of the cystitis. It is now quite certain that Sir Henry Thompson's assertion, that the return of voluntary power in the bladder is impossible after two years' use of the catheter, is incorrect.

There has been much variation in this respect in the recorded cases. So far as I know, there is no certain method of determining in advance whether a particular bladder is hopelessly dilated and atonic or still possesses power of recuperation. Of course in many cases the evidence of continued contractility will be unmistakable. But even after complete retention with the withdrawal of urine exclusively by the catheter for years there has been noted a satisfactory return of power in the detrusor, in some instances almost amounting to perfect health.

(9) The possibility of operating in the presence of an undetected calculus does not seem to me a very grave objection to the operation. The most unfavorable subjects for litholapaxy and for all forms of lithotomy are the advanced prostatics with cystitis

and deep post-prostatic pouches. If castration will, in even a minority of such cases, mitigate the vesical inflammation, and wholly or partially obliterate the cul-de-sac behind the prostate, it will certainly be deliberately adopted as a preliminary operation by many surgeons. I did this in one case (No. 107) with the most satisfactory results.

If the stone chanced to be found after instead of before castration, I cannot see that any serious difficulty would follow. Its removal would certainly be an operation both easier and less dangerous if prostatic atrophy had occurred.

(10) The assertion that the cases have been reported too soon to make the results reliable is true of some, but certainly not of all. The successful cases may be grouped as to time of report in three classes:[1] (1) Those reported immediately after the operation,—*i.e.*, within the first two or three weeks, and from which nothing further has been heard; these number seven, or 8.7 per cent. (2) Those in which from a month to three months elapsed before the patient passed from observation, and in which the prostatic changes and the improvement in symptoms were carefully noted. These number sixteen, or 20 per cent. (3) Those observed after three months, and in which the local changes seem to have reached their culmination and the health of the patient appeared to be permanently re-established. These were fifty-seven in all, a percentage of 71.3.

It is obvious that enough cases have been followed for a sufficient length of time to warrant belief in the permanence of the cure when once effected. That there may be remote general effects from the operation not now known or appreciated is, of course, a possibility. But it seems unlikely that anything new will be observed in this respect as castration is one of the oldest known operations, and has been investigated both as to immediate and remote consequences with great detail and thoroughness.[2]

The unfavorable results remain to be considered. The fatal cases have been twenty, a percentage of 18. But I would respectfully ask that in considering this apparently high mortality due consideration be given the attendant circumstances.

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[1] Exclusive of Moullin's ten cases.

[2] Mojon, Mémoire sur les Effêts de la Castration dans le Corps Humain. Genes, 1813; Curling, op. cit; Launois, op. cit.

In the first place, while I have included the series of cases published by Mr. Faulds, of Glasgow, I do not believe they should figure in the statistics. I have put them in only to ask permission to throw them out again. They are absolutely lacking in all the details which would be necessary to give value to them. If the operation were one which was dangerous in itself, they should, of course, be admitted, as well as all the successful cases, some of which are equally without detail. But in this instance a mortality of 80 per cent. in a series of five cases certainly requires explanation.

In only two of the cases is the age given. In only one is the size of the prostate estimated. In two the urine is said to have contained "pus and blood;" no other urinary examination is alluded to. In only one is the amount of residual urine mentioned. The condition of the patient as to general health is not once described. In other words, nearly all the factors upon which prognosis is based have been omitted. Moreover, it is stated of these patients that "some had been relieved, so far, of bladder and kidney disturbance by perineal section, all with the object of minimizing the immediate and remote effects of the operation." Perineal prostatotomy in such cases has a mortality of its own. It seems to me inconceivable that any one familiar with the literature of the subject should perform it "with the object of minimizing" the effects of castration. It will doubtless often be the operation of choice, and its previous performance need not necessarily prevent a later castration, but the combined operation would certainly have a higher mortality than either prostatotomy or orchectomy alone.

It would, of course, be easy if patients were selected in the condition of the one I have already reported to you (Case 104) to keep the mortality at those figures. But it is only proper that, if the operation is done (as was mine in that instance), as a justifiable, although apparently hopeless, attempt to give the patient the only shadow of a chance that offered, it should be so recorded. For these reasons, in estimating the true mortality of the procedure I would omit Mr. Faulds's four cases (Nos. 13, 14, 15, 16), and my own case (No. 104). Furthermore, it is remarked of case No. 36 (Glenn) that the patient was moribund at the time of operation. Case 103 (Watson) was delirious at the time of operation, and at the same time underwent operation for the cure of double inguinal herniæ. Case 52 (Lichty) was thought to be so unfavorable that the patient was only operated on when he expressed a preference for death as compared with a continuance of his sufferings. Case 43 (Haynes) lived for between two and three months. I have included it, but it can scarcely be considered an operative death. In case 13 (Faulds), a death from hemiplegia, nearly four weeks after the operation, seems scarcely chargeable to it, especially as the urinary symptoms were said to be " mitigated." Case 28 (Finney) had been insane at intervals before operation and died insane. Case 39 (Halsted) had a suprapubic cystotomy performed, as well as the castration. The prostate was " riddled with abscesses." Case 47 (Horwitz) was in " a desperate state," and it was merely a question as to what operation offered some hope with the least risk. Case 82 (Souchon) recovered power in the bladder, and died of pulmonary trouble at the end of six weeks. He had had a previous suprapubic prostatectomy, and had a permanent fistula.

Some of the others were scarcely less unfavorable, another of Halsted's being described as a " desperate case," in which *something* had to be done; but if I may be allowed to withdraw these thirteen cases from the list, so that we may get the legitimate average mortality in cases operated on with a reasonable expectation of cure, we have left a total of seven deaths in ninety-eight cases, a mortality of 7.1 per cent. I believe it will be less in the future. If so, it will accord with the history of every new operation in the matter of mortality. A table of ninety-five cases of suprapubic prostatectomy, arranged chronologically, shows, as I pointed out in 1893, a mortality of 20 per cent. for the whole number, but of only 15 per cent. for the last half; the mortality of the first half was 25 per cent.

I think a careful and impartial study of the cases in the table of deaths will show that in every one as to which details are given there was little to be hoped for from palliative operations, and less from the unaided efforts of nature, while it seems highly probable that any other radical procedure would have been at least equally likely to result fatally.

Moreover, even in these desperate cases it is most interesting to note that fifteen (75 per cent.) showed some distinct improvement in symptoms or some shrinkage of the prostate before they died.

But while there is little or no risk in the operation itself, if it is applied in the future as widely as it has already been,—*i.e.*, to patients of all ages and all degrees of weakness, of uræmia and of toxæmia,—it will, undoubtedly, always have a considerable mortality.

The average age of the eighty-six patients included in the table, whose ages were given, is sixty-six and a half years; the average age of the fourteen cases among those who died, in which the age was given, is between sixty-nine and seventy. Although the years of the patient must be an important factor in determining the result in this as in other operations, it is the *real* age rather than that of the calendar which will tell. The senility of the tissues, the degree and extent of arterio-sclerosis, especially as affecting the integrity of the kidneys, are more important than the nominal age. This varies widely in just these cases, the relationship between general atheroma and prostatic enlargement being so close that so distinguished an observer as Guyon has, as I have already mentioned, based upon it a theory of causation. I am strongly of the opinion that when we have enough detailed cases for broad generalization, we will find that the mortality of this operation will have a very direct relation to a few factors, the most important being the presence or absence of renal infection, and the history of long-continued catheter life, or of a number of attacks of complete retention, or of a very large amount of residual urine. If these factors are conjoined, the case would be of the most unfavorable type, the suppurative disease of the kidneys following infection crippling to the point of uselessness organs already suffering from the effects of prolonged backward pressure. In the forty-seven cases in which the duration of the prostatic symptoms was stated definitely the average is seven and a half years. In the six fatal cases in which the duration was specifically given the average is only four years. In the twenty-two cases in which the period during which the catheter was used is stated definitely the average is four years. In the five instances in the table of deaths it is 3.4 years.

Differences in the size, the density, and the shape of the prostatic overgrowth will probably be found to be minor factors in determining mortality, and more important ones in relation to the degree of improvement effected by the operation, and to the rapidity with which it occurs. After careful study of the cases, I do not think we have the data for positive conclusions on these points. Of the 111 cases only nineteen were not definitely stated to have been improved at the expiration of varying periods. Of these nineteen, nine were included in the table of deaths, leaving only 10 per cent. of apparent failures. But as in many of the whole number no mention is made of the density of the overgrowth and no estimate of the size, it is impossible to say whether or not these failures were due to the fact that in these cases the enlargement was of the hard and fibrous variety, with an abundance of connective tissue and relatively little glandular structure. Prostates thought to show this kind of enlargement have been reported as shrinking with rapidity, but, of course, the observers may have been mistaken. It is encouraging to note, however, that the microscopic studies thus far made seem to indicate an atrophy of the stroma almost as rapid as that of the glandular element.

The remote results of the operation cannot yet be determined. The cases of death with precedent mental symptoms described as " mania," " acute mania," " childishness," etc., are only such as every surgeon is familiar with in a certain proportion of cases of operation on aged persons whose mental equilibrium is easily disturbed, and can have no bearing on the question of later mental changes as a result of the castration. With greater accuracy we would probably classify the large majority of them as " uræmia," and some of the remainder as " traumatic delirium." It is worthy of note that no mental or physical changes whatever (except favorable ones) have been noted in a single one of all the successful cases, some of them now dating back for nearly a year and a half. All the information we have on this subject—and it is far from scanty—leads to the belief that the removal of the testicles from persons who have reached full adult life, and *a fortiori* from aged persons, has no effect whatever on the mental functions or on the general physical characteristics. Impotence will undoubtedly be caused in the majority of cases, but even this is not inevitable (see Cases 7, 42, and 92).

Properly to compare this operation with the other methods employed in the treatment of prostatic enlargement it seems necessary, as its position is still so indeterminate, to review briefly the procedures appropriate to various conditions and stages of hypertrophy.

(1) *Dilatation.*—A patient who presents the symptoms of the prostato-vesical congestion of the early stages of hypertrophy, who is disturbed once or twice at night, who has an enlargement of moderate density, appreciable through the rectum, but not offering much resistance to the introduction of an ordinary catheter, and who has but little residual urine, is likely to derive great benefit from the systematic introduction of full-sized steel sounds. This treatment alone often seems to relieve existing symptoms and to prevent or, at least, delay the development of further trouble. Of course, while this is the case no more radical treatment would usually be considered.

(2) *Catheterism* should be systematically employed in cases in which the quantity of residual urine is three or four ounces or more, and in which the introduction of the instrument is easy and painless, and the urine is sterile. The frequency should be proportionate to the amount and character of the residual urine, a very good working rule (if the urine is sterile) being to use the catheter once daily (preferably at bedtime) for three ounces, twice for six ounces, and then once more for any additional two ounces. With sterile urine it is rarely necessary to use it oftener than once in every four hours.

It may be said at once that in those patients with but moderate obstruction, or with a high grade of compensatory hypertrophy of the bladder, with a small amount of residual urine, which remains sterile, and in whom catheterism is easy and painless, operation is not to be thought of. The time may come when, by perfecting our methods of diagnosis and our operative technique, this class of prostatics may be benefited by active surgical interference, but it has not yet arrived. Dilatation and catheterism, as above described, at present represent the best therapeutics, especially if the rigid observance of details of antisepsis is emphasized, insisted upon, and never lost sight of.[1] But it must be remembered that these methods are, in the majority of cases, merely palliative, and that, as a rule, the introduction of instruments gradually becomes more difficult, cystitis and atony of the bladder result from the catheterism, which increases in frequency and painfulness and some operative measure must be considered. At this time castration will probably be rejected in the large majority of cases on account of the sentimental objections to the operation. Launois has said truly that even men whose sexual powers have vanished desire to preserve the testes as evidence of a *virilité passée*. The dominating position of the sexual instinct throughout the whole animal kingdom makes this feeling on the part of the patient readily comprehensible. But I cannot so easily understand why the surgeon should be expected to regard this sentiment or, indeed, the function itself with reverence. I am strongly disposed to agree with a medical man who writes me, " When a man in advanced years suffers severely from the disabilities and dangers caused by an enlarged prostate, it is difficult to understand why the preservation of a sexual function which has become useless to humanity and a constant menace to his own comfort and safety should be considered as an especially sacred duty."

I hope that this operation will occasionally, at least, be considered at this stage when some operation is for the first time clearly indicated and justified, and when all operations would be attended by better results than if done later. It would then come in competition with,—

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[1] ANNALS OF SURGERY, August, 1893.

(3) *Over-Stretching of the Prostatic Urethra.*—This procedure is not likely to be followed by good results in cases in which the median lobe and the vesical neck are chiefly concerned. In those of lateral hypertrophy, in which the urethra is simply narrowed, and is narrowed and rendered tortuous, it might be of use. If it is tried it should certainly be conducted under ether, and should be carried to the furthest degree consistent with safety. This operation may be said to be indicated (tentatively or experimentally) in those cases in which palliative treatment has failed and more radical measures are declined. Its results are doubtful. There should, of course, be almost no mortality; but, on the other hand, nothing like a cure could be anticipated.

(4) *Perineal prostatotomy*, with prolonged drainage or the formation of a permanent fistula, will undoubtedly be preferred in many cases. Its mortality is only about 4.5 per cent. It often relieves the cystitis and will sometimes effect a cure,—*i.e.*, after withdrawal of the tube, or after cessation of the vesical irrigations through the wound, the latter will close and there will be no return of obstructive symptoms. The precise mode by which it acts has not been demonstrated, but it seems probable that it is a combination of mechanical dilatation of the channel with a certain amount of cicatricial contraction in the substance of the gland, reducing its bulk in the immediate vicinity of the urethra and thus diminishing its obstructive power.

I wrote, in 1893,[1] "The operation should be regarded as that of choice in all those cases in which, with marked diminution of expulsive force and with cystitis, there are also evidences of wide-spread degenerative changes or of distinct renal disease, and toxæmia and general feebleness are present. It is also to be preferred, as a rule, even in the absence of renal or constitutional symptoms if the bladder is rigid and contracted, and will hold only a few ounces of urine, or if the atony is nearly absolute and does not tend to improve under careful treatment." It must be said, however, that its proper place is among palliative operations; that in the majority of cases the fistula must be kept open throughout life; and that it will often refuse to close even when it is desired that it shall do so. The inconvenience of this condition, and the undoubted risk of renewed vesical infection attending a permanent fistula (which will often suppurate continuously), seem to me to compare very unfavorably with the results obtained in the average cases of castration. If the latter operation were done under the same circumstances as perineal prostatotomy, its mortality would probably be less and its results as regards re-establishment of function infinitely better.

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[1] ANNALS OF SURGERY, August.

(5) *Suprapubic cystotomy with prolonged drainage or with the formation of a permanent fistula* has a mortality but little greater than the previous operation, gives equally good drainage if properly performed, and has the advantage of permitting a more thorough exploration of the bladder and of being converted into a prostatectomy if the condition warrant it. It offers no prospect of cure, however, is altogether inapplicable to cases with small rigid bladders, and even with Buckston Browne's excellent apparatus, or with McGuire's or Morris's ingenious modification of the operation, the patient's person and clothing are apt to be urinous and offensive, and there are many minor inconveniences.

I believe that, with the "sentimental" objection put aside, there is little to be said in favor of the operation as compared with castration.

(6) *Perineal Prostatectomy.*—The chief clinical indications for this operation may be said to be those already enumerated as justifying prostatotomy, which may always be converted into a prostatectomy if the perineal distance permits the growth to be reached by the finger, and it is found to be of small size and limited to the median line posteriorly, or pedunculated and acting like a ball-valve at the neck of the bladder. The chief objections to the method as a formal procedure, when a radical operation has been determined upon, are that in only about one-third or one-fourth of the cases (Watson, McGill) could the growth be reached by the finger of the operator; that often, even when

accessible to the finger, it cannot be satisfactorily dealt with through the narrowed urethra; and that vesical projections are altogether beyond reach for accurate or careful manipulation. It has a mortality of 14.3 per cent., and on that account and on account of the comparative uncertainty of results should, I think, be only exceptionally employed, and will not often be weighed in the scale with castration. The practical advantages certainly seem to rest with the latter operation.

(7) *Suprapubic Prostatectomy.*—Of this operation I wrote in 1893[1] that it was "the operation to be preferred in all those cases in which, palliative treatment having failed, there are unmistakable indications that the local conditions are growing worse, the general health remaining as yet unaffected. The best possible period is that before the development of marked and continuous cystitis, while some power still remains in the vesical walls, and the bladder is neither thinned and dilated nor rigid and contracted. Under these circumstances, in the presence of a patient who reports that he is disturbed at night with increasing frequency; that he is obliged to use the catheter oftener, and not only does so with greater discomfort but with less relief in the interval; that the urine is occasionally turbid and offensive; that he has recently had one or more attacks of retention, and that he is beginning to lose flesh and appetite, it appears to me that the indications for operative interference are unmistakable, and that the suprapubic method is obviously the one to be selected."

Is this true to-day? If the operation of castration holds its own, it will be because it has manifest advantages over the one we are now considering. I believe that those advantages exist and are as follows: (*a*) The mortality of the first extensive series of suprapubic prostatectomies published was 25 per cent. The mortality of my table of a slightly larger number of cases is 18 per cent., including every known death even when it occurred months after operation. The true mortality, as I have already said, I believe to be about 7 per cent. The death-rate will be lower in the future in both operations, but the proportional difference in favor of castration will probably persist or increase, as castration is a simple, easy, rapid procedure, without danger *per se*, and requiring for its safe performance only a proper selection of cases. It seems to me not unfair to add that in the present instance the facts have been obtained largely by personal solicitation, and that unfavorable cases have not been suppressed. (*b*) The return to local and general health in the successful cases has been more complete and vastly more rapid than after prostatectomy. A re-establishment of almost perfect health appears to have occurred in fifty-one cases (51.2 per cent.[1]) within from four to twelve weeks. (*c*) Vesical contractility was re-established, cystitis disappeared, and all pain ceased in such a large proportion of the successful cases that it seems unlikely that any operation which opens the bladder and necessitates healing by granulation will secure equivalent results; certainly suprapubic prostatectomy has not yet done so. (*d*) A permanent fistula may follow suprapubic prostatectomy and prove a continual source of annoyance even when all the other results have been favorable. (*e*) It is too soon yet to compare the relative dangers of relapse. Case 81 (Souchon) is, however, interesting in this respect. The patient had been taught to use the catheter for himself after a suprapubic prostatectomy in October. In February he returned because the introduction of the instrument had become impossible. Although more than 70 per cent. of the cases of castration in the table had been observed for over three months, in not a single one did relapse occur.

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[1] Loc. cit.

I concluded my paper in 1893 with the remark "that if we ever reach a point in certainty of knowledge in this direction comparable to that already attained in regard to oöphorectomy in relation to uterine fibroids, and can promise equivalent results, there will be no lack of cases willing to submit to an operation almost painless, with a low mortality, and followed by no such unpleasant conditions as accompany persistent fistulous tracts, either suprapubic or perineal, even although the operation carries with it the certainty of sacrificing whatever sexual power has survived the excessive and often intolerable sufferings of such patients."

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[1] Exclusive of Moullin's ten cases.

I find that Greig Smith[1] says that the general mortality of oöphorectomy for myomata is somewhere near 10 per cent. He adds, "As to the results, we may, in every thirteen cases of recovery after operation, reckon upon complete cure,—*i.e.*, shrinking of the tumor and menopause, in ten cases, improvement in two, and failure in only one." An examination of the table of castrations shows that with that as a basis we may in every thirteen cases of recovery count upon eleven being complete cures in the sense of shrinking of the tumor, one being improved, and one being unsuccessful.

The analogy which I have always thought so remarkable between the two conditions and the indications for operation is thus even more strikingly illustrated by the results of operation; and the number of cases already reported amply justifies the prophecy I ventured to make in regard to the willingness of patients to be operated upon.

## Part III.

(1) *Unilateral Castration.*—A number of observations have been recorded from time to time seeming to show the same sort of relation between a single testicle and the corresponding lobe of the prostate that has now been demonstrated to exist between both testicles and the entire gland.

Godard[2] long ago showed that if a testicle undergoes an arrest of development, or if its migration is incomplete, the prostatic lobe and seminal vesicle of the affected side undergo atrophy. Others (Lennox, Watson) have made the same observation, and it is now quite clear that there is a definite relation or sympathy between each testicle and the lateral lobe of the prostate and the seminal vesicle on the corresponding side. A few illustrative cases will suffice.

Bezançon[3] has recorded a case which is of special value because it was possible to make a full histological study of the prostate. Launois's[1] abstract shows that in a man twenty years of age, with an undescended and atrophied testicle, situated in the left iliac fossa, there was atrophy of the prostate and seminal vesicle on the same side. The patient died of pulmonary tuberculosis. The atrophy was of sufficient extent to be easily noticeable by sight and touch. The microscope showed it to be most marked as to the glandular tissue. Launois reports a similar case in a man forty years of age. He also records a case of one-sided atrophy of the prostate corresponding to a testicular atrophy following a number of attacks of gonorrhœal orchitis. Much similar evidence might be adduced, but a brief study of the literature is convincing as to the possibility of influencing one side of the prostate by castration on the same side. These facts led me to write to the *Medical News* (February 9, 1895), asking for information from surgeons as to the effect of unilateral castration upon the total bulk of the prostate. I remarked that existing evidence was scanty, but seemed to point clearly to one-sided atrophy of the prostate as a common result of the removal of one testicle and that some experiments which I was making on dogs corroborated this view, as did the observed condition of the prostate in monorchids. I added, "If it is found that the diminution in size extends to the other lobe, or if the shrinking of one lobe will in any large proportion of cases remove or lessen the mechanical obstruction to urination, the operation might at once be extended to a much larger number of patients and at an earlier and more favorable stage of the disease." Since sending this letter, the following communications have been published or have been received by me:

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[1] Abdominal Surgery, Second Edition, p. 187.

[2] Études sur la Monorchidie, Paris, 1857.

[3] Étude sur l'Ectopie testiculaire du jeune âge et son Traitement. Thèse de Paris, 1892.

H. E. Clark[2] said that on February 25 he had performed unilateral castration in the case of a man sixty-five years of age, whose catheter history covered a period of five years. The patient had done well and was making a good recovery, but the time was too short to permit of changes in the prostate being noticed.

Mr. Fenwick[3] reported a series of interesting cases. In three cases of unilateral castration nothing definite was felt in two; in the third the prostatic lobe on the same side was larger than its fellow. In two cases of monorchidism there was one instance in which the prostate was smaller on the affected side and one in which that side was the larger. In six cases of extreme atrophy of a testis consecutive to inflammation there were two in which the prostate was symmetrical and four in which the larger lobe was on the same side as the atrophied testis. In nine cases of extreme atrophy (cause unknown), seven had both lobes of the prostate equal, one had a smaller lobe on the side of atrophy and one a larger lobe.

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[1] Annales des Maladies des Org. Gen.-Urin., October, 1894.

[2] British Medical Journal, March 9, 1895.

[3] British Medical Journal, March 9, 1895.

Mr. Fenwick adds, "I point out with some diffidence that these cases are mostly at variance with Dr. White's surmises. At the same time I am aware that rectal examination, however skilled, is as uncertain a guide to the activity of the prostate as it is unreliable for estimating the amount of urinary obstruction which may be present. Moreover, none of us know the normal shape of the prostate, for it varies with each decade and with each individual. Lastly, few seem to appreciate the fact that the prostate is often changed in rectal contour by posture, by vesical distention, and by excessive use."

The following letter was sent February 16, 1895, by Dr. W. G. Fulton, of Scranton, Pa., to the editor of the *Medical News*, and was kindly referred to me,—"Sir: In reply to the request by Professor White, in the *News* of February 9, for information concerning the effect of unilateral castration on the prostate, I have a case which may be of interest. In November, 1893, Patrick M. entered the Lackawanna Hospital suffering from a diseased testicle. He had also an enlarged prostate, and could pass his urine only by aid of a catheter which he had learned to use himself. On December 1, I removed the diseased testicle, and before leaving the hospital, January 13, he could urinate freely without the aid of an instrument. The prostate at that time had perceptibly diminished in size, but I did not observe that there was then any marked difference in the size of its two sides. I have not been able to see the case since."

Dr. H. W. Rand, of Brooklyn, wrote me that on examining the prostate of a patient, aged fifty-one years, whose right testicle had been removed for disease nineteen years ago, he found the right side of the prostate somewhat larger than the left.

Mr. Aslett Baldwin,[1] of the Middlesex Hospital, recorded the result of an autopsy on a monorchid, aged forty-nine years, in which the prostatic lobe was only one-eighth inch smaller on the affected side than on the other.

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[1] British Medical Journal, March 30, 1895.

Dr. P. C. Remondino[1] said that in four recent cases of unilateral castration for other diseased conditions in elderly subjects, two had had a well-pronounced prostatic enlargement, and in them the operation was soon followed by a remarkable diminution in size.

Dr. S. C. Graves, of Grand Rapids, Michigan, wrote me May 8, 1895, as follows: "On October 20, 1894, I removed the right testicle of a gentleman, aged twenty-four years, for syphilitic orchitis. I have examined his prostate, and find that the corresponding (right) side of the organ has undergone decided atrophy. The left side seems to be normal."

Mr. Charles Morton[2] publishes the following interesting communication: "Dr. J. William White[3] requests surgeons to report cases of unilateral castration in which examination of the prostate was made. On March 7, I removed from a young man, aged seventeen years, an imperfectly-developed right testicle, which was lying just over the pubes and was surrounded by a 'congenital hydrocele.' Probably it had been retained within the inguinal canal in childhood, and had thus failed to develop. It was in constant danger of pressure against the pubes, the hydrocele only filling when he moved about and disappearing again during recumbency. I removed the testicle and hydrocele sac together. Seven weeks after the operation, and when he came to show himself at the hospital on April 25, I examined the prostate and found most decided atrophy of the corresponding side. There was, indeed, nothing on the right side at all corresponding to the lobe on the left, which is very well developed. It is difficult to say whether this is due to the imperfect development or removal of the testicle. When we remember the rapidity with which atrophy has occurred in enlarged prostate after bilateral castration, it is quite possible that the small size of the right side in this case is due to atrophy following the operation, and I am inclined to think that this was the case, as, although the right testicle was much smaller than the left, yet it contained a fair amount of gland tissue which appeared normal in structure."

[1] British Medical Journal, April 6, 1895.

[2] British Medical Journal, May 11, 1895.

[3] British Medical Journal, March 2, 1895.

Dr. J. T. Haynes,[1] of Sandusky, Ohio, reports the case of a man, aged sixty-three years, with a hydrocele and a history of prostatic obstruction dating back for ten years. For several years he had to resort to catheterism. Tapping and injecting the hydrocele sac was followed by sloughing of the testicle and scrotum, for which unilateral castration was performed June 11, 1894. Dr. Haynes continues as follows: "The fourth day after operation the patient told the nurse that, much to his surprise, he had been able to pass some urine unassisted by the catheter. This condition gradually increased until the third week after operation, since which time he has not had the slightest difficulty in voiding his urine. He is to-day an inmate of the Home, enjoying the best of health, and perfectly free from dysuria or any complications resulting from operation. Rectal examination by finger shows a prostate gland much reduced in size, but possibly only atrophied on one side. I have given this case not to show any result as following the operation other than the effect produced upon the enlarged prostate, and, in honesty, I will admit that the atrophy of the prostate was not the point aimed at in the least in making the operation. But I am convinced of the beneficial effect to be derived from this procedure, and deem it, in all cases that will permit, the only course to pursue."

Dr. Haynes (Sandusky, Ohio) also sends me, May 25, 1895, the following interesting description of a recent case:

*History.*—Samuel H., aged seventy-two years; white; bachelor. Admitted to hospital of Ohio Soldiers' and Sailors' Home, August 13, 1894. Disability; hypertrophy of prostate associated with incontinence of urine and great vesical tenesmus during certain periods. In regard to past history, states that he has had gonorrhœa a great many times, and that he had syphilis during service in the late war. Has had frequent attacks of bladder trouble, and for seven or eight years has had gradually increasing difficulty in urination. States that at times physicians had failed to introduce catheter to relieve distended bladder.

*Present condition* is not good. Has pronounced valvular heart lesion and noticeable lack of good compensation; body fairly well nourished; odor of urine; examination of urine shows specific gravity 1021; no albumen; no sugar; pus found in large quantities and constantly present. By rectal examination prostate found to be exceedingly large, round, and the size of a lemon.

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[1] Medical Record, May 11, 1895.

*Treatment.*—General condition of patient with condition of bladder and urethra received first attention. Strictures were dilated and bladder daily washed out with silver nitrate solution, which relieved to a considerable degree the vesical tenesmus and reduced in quantity the pus contained in the urine. Patient was told of operation for relief of hypertrophy and readily consented.

*Operation.*—August 22, 1894. Ether given without difficulty. Parts previously prepared for operation; were then washed with bichloride 1 : 1000. Incision about four inches. Entire scrotal contents of left side removed. Cord dissected up and tied. Wound closed by interrupted suture. Drainage. Iodoform dressing. Reaction good. August 24 dressings removed, but were a little soiled. Patient complained of pain at the internal abdominal ring, for which morphine was given.

*Results.*—August 27, dressings removed and drainage-tube removed; no pain to speak of; dressing as before. September 2. Dressings changed. Nurse stated that when patient stood he could make his urine much better than before operation. 8th. Dressing removed and scrotum placed in suspensory bandage. Patient urinates quite well at times, but occasionally is unable to void any. Examination per rectum shows prostate to be reduced in size and changed in form; no tenderness on pressure. 12th. Patient goes out walking; staying in ward but little. Rarely fails to urinate freely; states that he feels like a new man. Prostate becoming much smaller. 20th. No difficulty in urination. Prostate much reduced. Form rapidly assuming that of normal. Nothing more is known of the case, as patient left a few days after this and has never been heard from.

On February 20, 1895, I operated on a patient, aged seventy-four years, sent me by Dr. Black, of New Castle. The man had been suffering from obstructive symptoms for some years. He was markedly uræmic, passing only eighteen ounces of albuminous urine in the twenty-four hours. The urine also contained much blood and pus. Catheterism was difficult and painful. Urine began to flow through a soft instrument when the eye of the latter reached a distance of nine and a half inches from the meatus. By rectal examination the prostate seemed to be about the size of an orange. There were six ounces of residual urine. The patient had constant vesical tenesmus, and was attempting to use the catheter at such times as he aroused from his uræmic hebetude. His general condition was exceedingly unfavorable, and he and his family were strongly averse to complete castration. For these reasons I did a unilateral castration on February 20 in the presence of the class, expressing frankly at the same time my very unfavorable views as to prognosis, which had already been communicated to the family of the patient. The operation was completed in two minutes, and was done during the first stage of anæsthesia. Chloroform was used. Some improvement in the urinary condition was noticed on the fourth day, when he passed a large quantity of urine with more ease, and it was found that the residual urine was only two ounces.

But the uræmic symptoms gradually deepened, and the patient died comatose on the fourteenth day.

*Autopsy.*—Section of lateral half. (*a*) The side corresponding to the castration. The section marked *a* is filled with proliferated cells, both muscle and connective-tissue cells. Some parts of the field are more cellular than others, and where few cells are to be seen indicate the new connective tissue that is being transformed from the proliferated cells. There has been no special contraction of tubules, nor are they widely separated from each other. The tubules themselves are filled with small flat cells, and some still retaining in part their columnar shape; these are the original proliferated columnar cells which line the tubules.

The cells in the lumen of the tubules are filled with fine granular matter, which has not taken the stain.

Section of lateral half. (*b*) There is only a trace of the usual cell-proliferation in the stroma. In some of the tubules there is beginning proliferation of cells, but it has not advanced sufficiently to show much.

On March 1, 1895, Mr. B., a man aged seventy-two years, and weighing 215 pounds, came to see me on account of marked prostatic hypertrophy. He had all the typical symptoms, and was apparently just at the beginning of a break-down in his catheter life. His prostate was at least as large as a small orange and was symmetrical. He had a half-pint of foul residual urine. He had had one testicle removed by Dr. D. Hayes Agnew, in 1885, for suppurative disease. I recommended removal of the remaining gland, but have not since seen the patient.

Dr. R. W. Taylor, of New York (personal communication, May 29, 1895), has had two cases as follows:

An old gentleman with marked prostatic obstruction had a suppurating and sloughing testis. After the gland had disappeared there was distinct relief of all the most urgent prostato-vesical symptoms.

An elderly patient with a very large prostate, apparently almost filling the rectum, and with intractable cystitis, developed tubercular disease of one testicle, which resulted in its removal. The prostate soon afterwards was found to be much shrunken, the urine cleared up, and all the obstructive symptoms vanished.

Dr. Bryson, of St. Louis (personal communication, May 29, 1895), has seen two cases of atrophy and disappearance of one testicle, in one after an epididymo-orchitis, in the other after phlebectomy for varicocele. In the former, thirty-six years later, and in the latter, after eleven months, no difference could be observed between the two halves of the prostate.

Mr. Langton, at a recent meeting of the Clinical Society of London,[1] mentioned that many years ago, after removal of a senile tuberculous testis from a patient who also had enlarged prostate, that organ diminished in size on the corresponding side. Three years later the other testis was removed, as the tubercle had appeared in it, and this second operation was followed by diminution of the prostate on that side.

Mr. Gould[2] removed a tuberculous testis from a young man in 1893, and the second testis early this year. After the first operation there was no decrease of the prostate, but a great shrinking after the second.

It seems obvious that, in view of the contradictory character of the observations above recorded, no safe deductions can be drawn from them at this time as to the practical value of unilateral castration in cases of prostatic enlargement. The clinical history of the cases of Dr. Fulton, Dr. Remondino, Dr. Haynes, and Dr. Taylor, and the microscopic evidence in my case, together with the slight but unmistakable improvement in urination in the latter patient, seems to encourage the idea that in a minority of cases this operation will be followed by enough atrophy of the prostate to mitigate the obstructive symptoms. This view is favored by the observations of Dr. Graves and Mr. Morton, and by the unmistakable one-sided atrophy observed in monorchids, and in some cases of acquired disease causing atrophy of one testicle. It is opposed

[1] Quoted in Medical Record, June 1, 1895.

[2] Ibid.

by the observations of Mr. Fenwick, Mr. Baldwin, and Dr. Bryson.

Some experimental evidence was obtained during an investigation into the effect of ligation or section of various constituents of the cord. In some cases the testicle on one side sloughed or atrophied, while the other remained sound. The prostate, however, did not vary regularly with the testicle, but in some cases showed no change at all; in others marked and general atrophy comparable to that caused by double castration. On the whole, it may be said that the evidence in favor of the operation warrants further investigation into its merits or demerits, but that it seems probable that the results, even though occasionally favorable, will be slow and uncertain compared with those following the bilateral operation.

(2) *Ligation or Section of the Vas.*—At the meeting of this association, in 1893, it was suggested (Dr. Mears) in the discussion that followed my paper that perhaps ligation of the vas deferens might be as efficacious as double castration. In an interesting communication Mr. Reginald Harrison[1] briefly reported a case of prostatic enlargement, in which, after declining to castrate the patient, who had importuned him to do so, he had, "as a compromise," divided the vasa deferentia subcutaneously immediately below the external abdominal rings. The patient thought he derived some benefit from the operation in a short time. Six or seven years later he was alive and well.

Curling discusses at length the effects upon the testes of deficiencies or imperfections of the vas deferens. (Diseases of the Testis, Chapter I, Section II.) He shows from observations of Hunter (1775), Cooper (1823), himself (1842), Gosselin (1853), Godard (1857), and others, that the vas may be obliterated from birth, or may become so from injury or disease without, as a rule, interfering with the development or the apparent health of the testicle. He says, "The engorgement of the seminal ducts with sperm is liable, it is true, to cause inflammation of the testicle, which may end in atrophy, but this is only a secondary and, indeed, a rare effect of the interruption in the excretory duct."

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[1] British Medical Journal, September 23, 1893.

Griffiths[1] has recently confirmed these observations by experiments upon young dogs. He details the results in four cases and sums up as follows: "Accordingly, when the vas deferens is ligatured in puppies there is no immediate result either upon the epididymis or testicle; nor is the growth of the latter in any way interfered with,—that is to say, the ligature of the duct does neither hasten nor retard the growth of the gland, and the testicle acquires its maturity both of structure and function just as if the duct had been left alone in its natural and previous state. Again, when the vas deferens is ligatured in full-grown dogs there occurs enlargement of the epididymis, with tenderness. This enlargement in part subsides, leaving it, together with the portion of the duct up to the seat of ligature, permanently enlarged from the accumulation of semen. The structure of the seminal tubules remains unaltered, and they are after a few days or a few months just the same, showing the active formation of spermatozoa, like those of the normal testis, the duct of which is left natural and undisturbed; therefore ligature of the vas deferens induces a slight enlargement of the epididymis and of the vas deferens up to the seat of ligature, but it does not interfere in any way with the structure of the seminal tubules or the production of spermatozoa."

In two other cases, however, the testicle showed structural changes, atrophy of tubules, disappearance of normal epithelium, absence of any traces of the formation of spermatozoa, etc. One of these cases was that of a hound eight to nine years old. The other was that of a man, aged twenty-one years, who had had the vas accidentally divided six weeks previously. Mr. Griffiths thinks it probable, in the light of his other experiments and of those that preceded his, that in these two instances some damage was done to the other structures of the cord.

In none of the foregoing investigations was any special attention paid to the condition of the prostate. I accordingly, during the month of January, 1895, with the help of Drs. Wood and Kirby, made a number of experiments upon dogs with a view to determining whether or not any practical benefit was likely to result from the procedure we are considering. The report of Dr. Kirby on the microscopical sections, taken after different periods of time, was as follows:

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[1] Lancet, April 13, 1895.

Dog No. 19.—Double ligature of the vas, without section, on both sides. Dog died on the eighth day. Weight of the animal, 10.850 kilos; weight of prostate, 9.070 grammes; about the normal weight for the prostate. Testicles apparently normal.

*Microscopical Examination.*—Little if any change can be noted in the prostate. It seems about normal. Possibly there is some cellular proliferation of the stroma. The time was evidently too short to demonstrate atrophic change. The testicles are not yet examined.

Dog No. 17.—Double ligature of vas, without section, on both sides. Dog died ten days after operation. Weight of the animal was 10.231 kilos; weight of the prostate. 4.310 grammes; showing a loss of weight in the prostate of 4.560 grammes. Testicles apparently healthy when removed from the animal.

*Microscopical Examination.—Prostate.*—There has been considerable proliferation of the connective and muscle cells, but only a small amount of fully-formed connective tissue has resulted. As a consequence the tubules are not so widely separated from each other. There is a proliferation of the cells of the tubules, the latter being lined by three or four layers of these cells. The cells are becoming flattened and in some parts of the field are undergoing fatty degeneration, as shown by the granular *débris* in the tubules.

*Testicle.*—In the testicle there has been a round-celled proliferation with no special change in the intertubular stroma. Some of the cells of the tubules are filled with fine granules (fat), and considerable granular material can be seen in the tubules showing that some of the cells have already undergone fatty metamorphosis.

Dog No. 20.—Double ligature of the vas, without section, on both sides. Dog killed on the twenty-fifth day. The weight of the animal was 15.419 kilos; the weight of the prostate was 6.630; showing a loss of weight in the prostate of 6.370 grammes. Both testicles were apparently sound when removed from the animal, but at the time of the preparation of this paper were not ready for the microtome.

*Microscopical Examination.—Prostate.*—There is a beginning proliferation of both the connective tissue and muscle cells, but as yet they have not been fully transformed into true connective tissue; although in some parts of the field the spindle cells are disappearing and but few are to be seen. The tubules have contracted, are somewhat smaller than normal, and in most of the section are filled with the same proliferated columnar cells, but which have been transformed into the small, flat, cuboidal-shaped cells. Only a few spots of fatty degeneration can be made out in the tubules.

Dog No. 6.—Vas cut between ligatures on both sides. Dog killed on the thirty-third day. The weight of the animal was 13.605 kilos; the weight of the prostate 2.480 grammes; showing loss of weight in the prostate to be 10.520 grammes. Testicles apparently healthy when removed from the animal.

*Microscopical Examination—Prostate.*—The stroma of the gland is made up largely of fully-formed connective tissue, in which may be seen some small spindle-shaped cells. In other parts of the gland there is still evidence of marked proliferation of the connective tissue and muscle cells. In those parts of the field where the connective tissue predominates, the tubules are contracted and somewhat irregular in shape. The tubules themselves are filled with the proliferated columnar cells, which have become flat and cuboidal in shape, and fatty degenerated cells very difficult to make out; only a small amount of granular material is to be seen in the tubules.

*Testicles.*—Very little, if any, change is to be seen in the testicles.

Dog No. 7.—Double ligature of vas with section on both sides. Dog killed on the thirty-seventh day. Weight of dog 9.977 kilos; weight of prostate was 1.010 grammes; loss of weight in prostate was 4.656 grammes. Testicles were not ready to cut.

*Microscopical Examination—Prostate.*—There has been a great proliferation of the pre-existing connective tissue and muscle cells, and in some parts these cells have given way to the new-formed connective tissue, so that we find between the tubules broad bands of fibrous tissue running between and surrounding them. In those parts of the field where the connective tissue is mostly found only a few cells (spindle-shaped) are to be seen. The tubules are contracted and somewhat irregular. The lumen of the tubules is filled with these proliferated columnar cells, which have become cuboidal in shape, some are granular in character, while others have entirely disappeared, leaving only a fine granular *débris* as a mark of their former existence.

Dog No. 16.—Ligature of vas (two ligatures without section) on both sides. Dog killed on the fifty-second day. Weight of the animal 22.222 kilos; weight of the prostate 4.350 grammes; showing a loss of weight in the prostate of 14.650 grammes. Testicles were apparently healthy when removed from the animal, but could not be cut in time for this paper.

*Microscopical Examination—Prostate.*—There is beginning rapid proliferation of the muscle and connective-tissue cells. Long chains of these proliferated spindle cells may be seen between the tubules in various parts of the gland. In other parts of the field the cell elements of the stroma have in part disappeared, and have been replaced by connective tissue, in which may be seen a few spindle-shaped cells. The tubules are considerably smaller than normal and quite irregular in outline. They are filled with these fatty cuboidal-shaped cells. In the lumen of some of the tubules fatty *débris* is observed.

Dog No. 18.—Double ligature of the vas on both sides without section. Dog killed on the fifty-second day. Weight of dog 19.300 kilos; weight of prostate 7.450 grammes; showing a loss of weight in the prostate of 11.650 grammes. Testicles when removed from the animal were apparently healthy.

*Microscopical Examination—Prostate.*—There has been great proliferation of the connective tissue and muscular elements. In some parts of the field there are large amounts of fully-formed connective tissue, in which may be seen a few spindle-shaped cells (connective-tissue cells). The tubules are filled with the proliferated columnar cells; some have undergone fatty metamorphosis, as shown by the granular material. In other tubules the proliferation has not gone far enough for beginning fatty change.

These results have been a surprise to me. Mr. Griffiths's paper was not published when the experiments were made, but the conclusions of Curling have never been disputed, and are doubtless correct. Indeed, as will have been observed, there are comparatively few changes in the testicles themselves. There was, however, a constant loss of weight in the prostate in every dog that died after eight days. Even at ten days this loss is perceptible. In the dogs which were kept for fifty-two days the atrophic changes are unmistakable, and they are to be found in nearly every section. If these results are reliable it will certainly be worth while to investigate still further the effect of obliterating the vas, although outside of these experiments there would seem to be every theoretical reason to agree with Griffiths, who says, "With regard to the suggestion made by Mr. Reginald Harrison of division of the vas deferens in cases of enlarged prostate, I have not sufficient experience to arrive at a conclusion; but, seeing that obliteration of the vas deferens has so little effect upon the structure and secretion of the testis, it must be doubtful whether the operation will suffice to influence the enlargement of the prostate."

Possibly I have wounded other structures in exposing and tying the vas, but I was very careful and the operation is easy.

It may well be that the whole effect upon the prostate caused by the removal of the testicles is exerted through the medium of the nervous system. It would be easy to make a strong argument in favor of this view basing it on well-known physiological facts. And it may also be that in tying or cutting the vas certain nerves, more potential than others, are included or are themselves divided. In the dog they are all small and difficult of recognition without an extensive dissection.

I wanted to tie or divide the nervous constituents of the cord alone and in a separate series of experiments, but the difficulty of finding them all and of avoiding damage to other structures was so great that I gave up the idea after some trials. Still, I should think it feasible and hope to make the attempt at some future time.

Dr. King, of Toronto, has, in two experiments on dogs, had results from dividing the vas precisely similar to those I have detailed, a fact which increases my confidence in my own experiments.

(3) *Ligation of Vascular Structures of Cord.*—The following reports explain themselves: the changes here were less unexpected, but in two cases, as might also be expected, the testicles sloughed, and in the third the epididymes were necrotic.

Dog No. 9.—Ligation of spermatic and deferential arteries on both sides. Dog killed at the end of the tenth day; weight of animal was 15.873 kilos; weight of prostate was 4.510 grammes; average loss of weight in the prostate was 8.490 grammes. The testicles were apparently of the normal size when removed from the animal, but the epididymes appeared to be gangrenous.

*Microscopical Examination—Prostate.*—In this section some parts of the field are very cellular and apparently in that part of the gland in which the muscular tissue predominates, while that part between the tubules has been converted into true connective tissue with only a few spindle-shaped cells to be seen. Some of the tubules are greatly contracted in these connective-tissue areas and filled almost entirely with a fine granular *débris,* which has come from the fatty, degenerated, proliferated columnar cells lining the tubule. In other parts of the field the tubules may be seen filled with these cuboidal cells which, as yet, are not far advanced in the fatty change.

*Microscopical Examination—Testicles.*—There seems to be an increased amount of connective tissue between the seminal tubules, but very few cells are to be seen. The tubules themselves are filled with proliferated small, round cells which are in an advanced stage of fatty degeneration.

Dog No. 5.—Ligature of spermatic and deferential artery on both sides. Dog killed at the end of the nineteenth day. Weight of animal 38.547 kilos; weight of prostate 12.450 grammes; showing the loss of weight in prostate to be 18.550 grammes. Both testicles had sloughed away. The animal was very old.

*Microscopical Examination—Prostate.*—In some parts of this section the stroma is quite cellular owing to the proliferated connective tissue and muscle cells, while in other parts of the field the cells seem to have disappeared to a considerable extent, giving place to a connective tissue in which may be seen a few spindle-shaped cells. This is noticeable in those parts of the field where the tubules have undergone contraction. The tubules are lined with three or four rows of these same small flat cells, which are the proliferated columnar cells, and in some parts of the field they entirely fill up the lumen of the tube and are undergoing fatty metamorphosis.

Dog No. 4.—Ligation of the spermatic artery and veins in both cords. Dog killed at the end of thirty-four days. Weight of animal

29.024 kilos; weight of prostate 3.100 grammes, showing a loss of weight in the prostate of 26.900 grammes, Testicles sloughed away.

*Microscopical Examination—Prostate.*—There is a beginning proliferation of the connective-tissue cells, and much more of the muscle cells, but only a small amount of new connective tissue has been formed. As a result there is but little change in the size of the tubules in many parts of the field; where the connective tissue exists there has been some contraction. There has been some proliferation of the columnar cells lining the tubules; in some parts of the field they are beginning to take on the cuboidal shape, while in other parts of the field they have not entirely lost their columnar outline. Some of the cells of the tubules appear to be granular in character, while others have undergone fatty degeneration, as shown by the fine granular material in the lumen of the tubules.

It may be doubted whether any practical advantage would be gained by adopting this procedure. It would scarcely meet the sentimental objections, as the testicles would be lost finally, at any rate, not only functionally but actually. The same remark applies to the next group.

(4) *Ligation or Section of the Entire Cord.*—This was done subcutaneously, and by the open method, with and without section of the cord between the ligatures. The results follow:

Dog No. 13.—Ligature of the entire cord; one ligature without section and on both sides. Dog killed at the end of sixteen days. Weight of animal 10.231 kilos; weight of prostate 3.800 grammes. The average weight of the prostate in dogs of 10 kilos. is 8.666 grammes, showing an average loss of weight in the prostate of 4.866 grammes. One testicle had sloughed away.

*Microscopical Examination—Prostate.*—There is beginning rapid proliferation of the connective tissue and muscle cells. Great chains of these proliferated spindle-shaped cells being seen between the tubules in various parts of the gland. In some parts of the field the cell elements of the stroma have in part disappeared, giving place to connective tissue, in which only a few spindle cells can be seen. This change can be especially seen around the small and contracted tubules. The tubules are somewhat smaller than normal, but not so irregular in shape as in the other specimens. They are filled with three or four layers of these small, flat, cuboidal cells. Some are granular in character, and the lumen of the tubes is filled with fatty, broken-down, columnar cells.

*Microscopical Examination—Testicles.*—The tubules of the testicle are filled with large quantities of fatty, degenerated and broken-down cells. A beginning proliferation of the connective-tissue cells in the intertubular tissue is observed.

Dog No. 1.—Subcutaneous ligature of both cords. Dog killed on the sixteenth day. Weight of dog 6.803 kilos; weight of the prostate 4.565 grammes. Testicles were large pus-cavities, so could not be cut.

*Microscopical Examination—Prostate.*—The stroma in this section is quite cellular from the proliferated connective tissue and muscle cells. Fully-formed connective tissue is not present to any great extent. The tubules are contracted somewhat and filled with the proliferated cuboidal cells. Some of the tubules are filled with these cells with beginning fatty degeneration, as shown by the granular *débris*. In some parts of the field the muscle-fibres can be seen gradually being transformed into connective tissue.

Dog No. 3.—Subcutaneous ligature of both cords. Dog killed at the end of twenty-one days. Weight of dog 13.152 kilos; weight of prostate 4.040 grammes. The average weight of the prostate in dogs from 13 to 15 kilos. inclusive is 13.000 grammes, showing a loss of weight in the prostate of 8.960 grammes.

*Microscopical Examination.—Prostate.*—There has been considerable increase in the intertubular connective tissue; a proliferation of the pre-existing connective-tissue corpuscle. In some parts of the field very few connective-tissue cells are to be seen in the intertubular tissue, having probably disappeared by fatty degeneration, leaving some fibres of connective tissue, followed by contraction of the tubules. The tubules themselves are somewhat contracted and irregular in shape, usually filled with the lining columnar cells. The cells on the basement membrane are very small, cuboidal in shape, often irregular and flat. The central proliferated epithelial cells can be seen in beginning granular degeneration.

*Microscopical Examination.—Testicles.*—The seminal tubules are filled with a mass of irregular-shaped cells and granular matter, evidently fatty degenerated cells, and there is in some parts of the field a proliferation of cells in the intertubular connective tissue; in some parts small bands of fibrous tissue are to be seen between the tubules. The lining cells are very flat and irregular.

Dog No. 14.—Cord ligated with one ligature on both sides, open method. Dog killed on the sixteenth day. Weight of animal 7.029 kilos; weight of prostate .460 gramme. Average loss of weight in prostate was 5.490 grammes, assuming 5.950 grammes to be the average weight of the prostate for dogs of 7 kilos weight. Testicles had sloughed away.

*Microscopical Examination—Prostate.*—There has been considerable proliferation of the pre-existing muscle and connective-tissue cells, especially seen in that part of the field which is composed of the muscular elements.

In the intertubular tissue these proliferated cells have disappeared in part, leaving here and there broad bands of pure connective tissue in which may be seen the usual spindle-shaped cell.

The tubules themselves are small and contracted, however, more or less regular in outline, filled in most parts of the field with these small cuboidal-shaped cells, which are the proliferated columnar cells lining the tubules. Some of these cells have a decided granular appearance (fat), while others have entirely disappeared, as shown by the granular *débris* in the lumen of the tubules (fatty degeneration).

Dog No. 2.—Subcutaneous ligature of the entire cord on both sides. Dog killed on the twenty-first day. Weight of dog 7.369 kilos; weight of prostate 1.790 grammes. The average weight of the prostate in dogs of 7 kilos is 4.950 grammes, showing a loss of weight in the prostate of 2.370 grammes.

*Microscopical Examination.—Prostate.*—The stroma in this section is extremely cellular, owing to the proliferation of the connective-tissue cells and of the unstriped muscle-fibre cell. In other parts the field is made up of large amounts of connective tissue with a few spindle-shaped cells here and there, surrounding a few isolated gland tubules. The tubules themselves are in some parts of the field filled with the same small cuboidal cells, while in others three or four rows deep line the basement membrane. In some the proliferation has gone on to such an extent as entirely to block up the lumen of the tubules. Some of the tubules are filled with granular material (fatty degenerated cells). In other parts of the field the muscle fibres can be seen in gradual transformation into the predominating connective tissue.

*Microscopical Examination.—Testicles.*—The seminal tubes are lined with four or five rows of irregular-shaped cells and proliferated cells, in some parts of the field almost entirely filling up the lumen of the tubules. In other parts of the field considerable granular matter is seen (fatty degeneration of the proliferated cells which lined the tubules). Many of the cells are filled with granular particles. The intertubular connective tissue shows proliferated connective-tissue cells in a few spots, but is otherwise unchanged.

Dog No. 15.—Both cords ligated with one ligature without section. Dog killed at the end of thirty-one days. Weight of animal 10.231 kilos; weight of prostate .980 gramme; showing a loss of weight in the prostate of 7.646 grammes. Both testicles had sloughed away.

*Microscopical Examination—Prostate.*—There has been great proliferation of the connective tissue and the muscle cells between the tubules; chains of these spindle-shaped cells can be seen running between the tubules, while in other parts of the field the cell elements of the stroma have in part disappeared, giving place to connective tissue in which only a few spindle-shaped cells can be seen. The tubules themselves are somewhat contracted, filled with masses of these proliferated cuboidal cells, which here and there have undergone fatty degeneration, and appear as a fine granular *débris* in the lumen of the gland tubules.

Dog No. 12.—The entire cord on both sides cut between ligatures. Dog killed on the thirty-first day. Weight of animal 14.866 kilos; weight of prostate 3.200 grammes; loss of weight in the prostate 9.800 grammes. Both testicles had sloughed away.

*Microscopical Examination—Prostate.*—In this specimen the cell elements of the stroma—namely, the proliferated connective tissue and muscle cells—have almost entirely disappeared, giving place to connective tissue. The gland tubules are widely separated from each other by the new connective tissue. They are very much contracted and irregular in shape, in some parts of the field filled with these small proliferated cuboidal cells, while in other parts of the field these have undergone fatty metamorphosis and appear as granular material in the lumen of the tubules.

Dog No. 11.—Cord cut between ligature on both sides. Dog killed on thirty-first day. Weight of dog 19.028 kilos; weight of prostate 4.730 grammes; loss of weight of prostate was 14.270 grammes. Testicles sloughed away.

*Microscopical Examination—Prostate.*—There has been great proliferation of all the cellular elements throughout the entire gland. This can especially be seen in the non-glandular parts of the gland. In the intertubular tissue the proliferated cells have almost entirely disappeared in some parts, having been converted into a true connective tissue, in which may be seen a few spindle-shaped cells.

As a result of this new-formed connective tissue the tubules themselves have undergone contraction and atrophy.

The true columnar cells have undergone proliferation, and, as a result of contraction, they have been changed into small cuboidal-shaped cells, which, in most parts of the field, fill up the entire lumen of the tubule. Some of the tubules show empty spaces filled with granular matter (cuboidal cells which have undergone fatty metamorphosis).

Dog No. 10.—Entire cord cut between ligature on both sides. Weight of dog 24.036 kilos; weight of prostate 2.490 grammes; loss of weight of prostate 18.510 grammes, taking the average weight of the prostate in dogs of 24 kilos. as 21 grammes. The testicles had entirely sloughed away. Dog killed at the end of sixty days.

*Microscopical Examination—Prostate.*—In this specimen the stroma is extremely cellular, being filled with immense numbers of spindle-shaped cells, which are the proliferated connective-tissue cell and muscle cells. In some parts of the field these cells have given away almost entirely to the connective-tissue element. The muscular elements have almost lost their identity as fibres and have been converted into bands of connective tissue.

The tubules themselves are small, contracted, irregular in shape, and widely separated from each other by the new connective tissue. They are filled up with the proliferated columnar lining cells, irregular in shape, and not unlike lymphoid cells as regards their outline. Some of them are filled with granular material, showing that fatty degeneration has taken place.

The results as regards the prostate in these cases are as unmistakable as though a primary double castration had been done. I took many antiseptic precautions during the operations, but it will be noticed that even in those animals whose cords were tied subcutaneously, the testicles never underwent a quiet atrophic process, but invariably sloughed. It might be possible to get better results in that direction in human beings.

## SUMMARY.

The conclusions which seem to me warranted by the arguments used and the facts set forth in the foregoing pages are as follows:

(1) The function of the testis, like that of the ovary, is twofold,—the reproduction of the species, the development and preservation of the secondary sexual characteristics of the individual. The need for the exercise of the latter function ceases when full adult life is reached, but it is possible that the activity of the testis and ovary in this respect does not disappear coincidently, and that hypertrophies in closely-allied organs like the prostate and uterus are the result of this misdirected energy. This hypothesis would increase the analogy between the fibromyomata of the uterus and the adeno-fibromata of the prostate, which, from a clinical stand-point, is already very striking, and is further strengthened by the almost identical results of castration in the two conditions.

(2) The theoretical objections which have been urged against the operation of double castration have been fully negatived by clinical experience, which shows that in a very large proportion of cases (thus far in approximately 87.2 per cent.), rapid atrophy of the prostatic enlargement follows the operation; and that disappearance or great lessening in degree of long-standing cystitis (52 per cent.); more or less return of vesical contractility (66 per cent.); amelioration of the most troublesome symptoms (83 per cent.); and a return to local conditions not very far removed from normal (46.4 per cent.), may be expected in a considerable number of cases.

(3) The deaths have been twenty in 111 cases, a percentage of 18. But of these there seem to be thirteen that may fairly be excluded in an attempt to ascertain the legitimate mortality in patients operated upon under surgically favorable conditions,—*i.e.,* before the actual onset of uræmia or, better, before the kidneys have become disorganized by the two factors rarely absent in advanced cases,—backward pressure and infection. This would leave a mortality of 7.1 per cent., which will probably be decreased as advancing knowledge permits of a better selection of cases. It is important to note that even in the desperate cases which make up this series of deaths, fifteen (75 per cent.) showed improvement of symptoms or shrinkage of the prostate before they died.

(4) Comparison with other operative procedures seems to justify the statement that, apart from the sentimental objections of aged persons on the one hand, and the real, entirely natural, and very strong repugnance to the operation felt by younger patients, castration offers a better prospect of permanent return to nearly normal conditions than does any other method of treatment. The relatively greater degree of improvement in successful cases should be considered, as well as the mortality, in comparing the operation with the various forms of prostatotomy and prostatectomy. So, too, should the absence of any risk of permanent fistulæ, peritoneal or suprapubic, the ease and quickness with which the operation can be performed; and the possibility of avoiding altogether the use of anæsthetics which, in these cases, are in themselves dangerous.

(5) The evidence as to unilateral castration is at present contradictory, but there can be no doubt that in some cases it is followed by unilateral atrophy of the prostate, and in two cases, at least, it has resulted in a very marked improvement of symptoms. It is worthy of further investigation.

(6) My experiments on dogs have shown in nearly every case in which the vas deferens was tied or divided on both sides, that, without much change in the testicles, there were beginning atrophy and considerable loss of weight of the prostate. These

experiments need repetition and confirmation, as the absence of corresponding testicular change seems to make the results somewhat anomalous. It is possible that the inclusion or severance of small but important nerves may account for the effect on the prostate.

(7) Ligation of the vascular constituents of the cord, or of the whole cord, produces atrophy of the prostate, but in my experiments only after first causing disorganization of the testis.

| Operator. | Date of Operation. | Reference. | Age of Patient. | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization. | Estimated Size of Prostate befor Operation. |
|---|---|---|---|---|---|---|---|---|---|---|
| Andrews, Chicago. | June, 1894. | Tri-State Med. Journ., Mar., 1895. | 75 | . . . . . . | Power of erection had nearly ceased. | Severe and continued. | . . . . . | 20 years. | . . . . . . | Prostate began enlarge at age 50. |
| Bard, Ventura, Cal. | Dec., 1894. | Personal Communication, Feb. 9, 1895. | 72 | 10 years. | . . . . . | . . . . . | Abundance. | . . . . . | Urinating 5 or 6 times every night. | Enlarged at leas one-third. |
| Beach, Boston. (See p. 15.) | Dec. 11, 1894. | Personal Communication, May 1, 1895. | 70 | 10 years. | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | Greatly and un formly enlarge nearly reache the ischium late ally, as far the finger coul reach posterio ly; in front, projected an inc above the su perior line of t pubes. |
| Bereskin, Moscow. | . . . . | Chirurg. Annalen, 1894, p. 802. (Russisch.) | 70 | . . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | Urinated 10 times during night. | Greatly enlarge long diameter, to 6 cm. |
| Reported by Moullin before the Clinical Society of London Case under the care of Dr. Birch. | . . . . | British Med. Journ., May 4, 1895. | 74 | . . . . . . | . . . . . | Persistent. | . . . . . | . . . . . | Urinated 14 to 15 times at night. | Enormous size. |
| Bryson, St. Louis. | Jan. 17 1895. | New York Med. Journ., Apr. 27, 1895 | 74 | . . . . . . | . . . . . | Mild grade for 14 months. | . . . . . | . . . . . | . . . . . . | . . . . . . . . |
| Bryson, St. Louis. | . . . . | . . . . . . | . . . | . . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | Enlarged. |
| Carver, London. Reported by Griffiths. | Nov. 16, 1894. | British Med. Journ., Mar. 16, 1895. | 74 | Severe cystitis for many months. | . . . . . | Yes, for many months. | . . . . . | 2 years. | Urination very frequent and very painful, passed but a few drops at a time. | Medium-sized ange. |
| Cole, Buena Vista, Col. | Mar. 6, 1895. | Personal Communication, Apr. 4, 1895. | 51 | . . . . . . | . . . . . | . . . . . | . . . . . | 1 year. | Frequent. | Size of hen's eg |
| Collins, Providence. | Jan. 15, 1895. | Personal Communication, Jan. 30, 1895. | 62 | 10 months. | . . . . . | . . . . . | . . . . . | 6 months. | . . . . . . | Fully half the s of an orange. |

| General Symptoms and Condition. | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Result; Other Remarks. |
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| ad not a day free from distress in twenty years. Frequent attacks of orchitis. | . . . . . . . . . . | Prostate was diminished in size, but still caused an obstruction requiring the use of the catheter. Cystitis permanently cured. | Pain of testes and cystitis ceased at on (the latter had tormented him for twen years). Patient has grown vigorous, h increased in weight, and resumed l business activity. The former remna of his virility has disappeared. He h "hot flushes," like a woman after t menopause. |
| icturition frequent, distressing and interrupted urine loaded with mucus, ammoniacal. | . . . . . . . . . . | Reduction in size of gland and symptoms very materially relieved. Sometimes able to pass the night without urinating, and never has to rise more than once or twice (Feb. 9, 1895). | . . . . . . . . . . . . . . . . . . . |
| ladder much distended and constant dribbling of urine. Moderate hydrocele on left side. Urine contained pus and albumen. Urine carefully drawn twice daily, still there was some dribbling. Has been failing mentally for a number of weeks. He was in bed all the time and was dull and listless, and later became stuporous. Nov. 23, passed no more urine voluntarily. Dec. 5, great difficulty in passing catheter. Dec. 6, no urine passed for twenty-four hours. Impossible to pass catheter. Suprapubic puncture. Hydrocele had increased to three times its size on admission. Dec. 7, 8, 9, aspiration and failure to pass catheter. Dec. 10, aspirated and passed small catheter which was retained. | No difficulty in passing catheter after operation. | Dec. 20, has improved steadily and to-day passed three ounces urine voluntarily; prostate found at least one-third less in volume. | Dec. 27, out of bed, improving. Jan. passed several ounces of urine witho catheter. Jan. 8, patient passed cathe without assistance, later passed ei ounces of urine without assistance; mi clear, and patient intelligent. Jan. passed all the urine without cathet much improvement, mentally and phy cally. Results in this case confirmed Dr J. Collins Warren. |
| bstruction to passage of fæces. | Earlier than five weeks. | At end of five weeks, the prostate was greatly reduced in size, more force to stream of urine, urinated but three times in night. | Two and one-half months after operati the prostate is smaller than normal; patient declares himself entirely well. not obliged to pass urine at all at night |
| Urine ammoniacal, bladder contracted so that it would hold but two ounces, intense strangury. Used morphine suppositories constantly. Longest period of sleep secured, three-quarters of an hour. | Ten days. | The patient had dispensed with morphine, could sleep one and one-half hours at times, prostate smaller, stream of urine larger. | One month after operation the urine acid, the strangury had almost gone, bladder could retain four ounces, and much less sensitive, and the conditio the patient was immensely improved. |
| The patient had a weak and dilated heart, irregular pulse, albumen and hyaline and pale granular casts. He came to the hospital to have suprapubic prostatectomy performed, but his condition would not permit of so grave an operation. | Few weeks. | Reduction in size of prostate and greater ease with which catheter may be passed. | May 15, reduction in the length of the pr tate, as measured by the catheter, fr two and one-half to one inch. Disti reduction in prostatic mass, as estima by rectal touch. Frequency of urinat day and night unchanged. Pus, al men, and specific gravity unchang quantity slightly increased. Rises fou five times at night to urinate; cathe passes with greater ease. |
| . . . . . . . . . . . . . . . . | One year. | Shrinkage of prostate. | Connection nearly a year afterwards. end of year, improvement began in n turnal frequency of urination, and pr tate had apparently diminished in s Fifteen months later had absolutely trouble with urination. |
| The urine contains a large amount of mucus and pus. Urination was very frequent and very painful, only a few drops being expelled at a time. Had an attack of retention two years previously. As there was but little improvement from washing out the bladder and the frequent use of the catheter, and as there was much pain with little prospect of relief, he consented to castration. Testicles of full size. In the left, a large spermatocele. In each there were numerous active spermatozoa. | One week. | At the end of a week, the patient could pass for the first time in some weeks a few ounces of urine without the aid of the catheter. During the second week, the general condition slightly improved, the bladder became quiet, and he was able to empty his bladder fairly well. Towards the end of the second week he became sleepless, delirious. On the fourteenth day, the right popliteal artery became blocked, and gangrene appeared on the leg. The condition grew worse, and he died on the eighteenth day. | *Post mortem.*—The right kidney much larged from chronic hydronephrosis, there was suppuration of the disten pelvis and the remaining portion of kidney substance. The bladder much thickened, and the mucous m brane inflamed, as was also the ri ureter. The prostate was still of la size, and was somewhat firmer than gland is ordinarily. |
| Bladder inflamed. | One week. | Voluntary urination. | One month later gland size of walnut. not used catheter since one week a operation. Bladder and urine normal |
| . . . . . . . . . . . . . . . . | Three weeks. | Feb. 6, patient passed all his urine voluntarily, something he had not done for seven months. Prostate estimated to be one-sixth smaller. The urine has cleared up and is perfectly normal. | The operation has produced a most ha result, and the patient declares that has not felt so well in years. |

| Operation. | Date of Operation. | Reference. | Age of Patient. | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization. | Estimated Size of Prostate before Operation. |
|---|---|---|---|---|---|---|---|---|---|---|
| Crisand, Worcester, Mass. | Jan. 9, 1895. | Personal Communication, Jan. 21, 1895. | 68 | ... | ... | ... | ... | 6 months. | ... | ... |
| Eastman, Indianapolis. | April 20, 1895, | Indiana Med. Journ., May, 1895. | ... | ... | ... | Yes. | ... | Had not passed any urine except by use of catheter for 1 year. | ... | Transverse diameter, 2½ inches. The third lob extended up int the bladder, rendering the passage of any instrument except th most flexible impossible. |
| Faulds, Glasgow. | Dec. 24, 1894. | British Med. Journ., May 4, 1895. | 66 | ... | ... | ... | 12 ozs. mixed with blood and pus. | 3 years. | ... | Very large; its upper limit coul scarcely b reached throug the rectum. |
| Faulds, Glasgow. | Jan. 3, 1895. | British Med. Journ., May 4, 1895. | 71 | ... | ... | ... | ... | ... | ... | ... |
| Faulds, Glasgow. | Jan. 12, 1895. | ... | ... | Passed blood and pus 6 years. | ... | ... | ... | ... | ... | ... |
| Case observed by Faulds, Glasgow. | Jan., 1895. | British Med. Journ., May 4, 1895. | ... | ... | ... | ... | ... | ... | ... | ... |
| Faulds, Glasgow. | ... | British Med. Journ., May 4, 1895. | ... | 4 years. | ... | ... | ... | ... | ... | ... |
| Fenwick. | ... | British Med. Journ., Mar. 16, 1895. | 46 | 10 years. | ... | ... | ... | ... | ... | ... |
| Fenwick, London. | ... | British Med. Journ., Mar. 16, 1895. | ... | ... | ... | ... | ... | ... | ... | ... |
| Fenwick, London. | ... | British Med. Journ., Mar. 16, 1895. | 45 | ... | ... | ... | ... | ... | ... | ... |
| Fenwick, London. | ... | British Med Journ., Mar. 16, 1895. | 76 | Some years of feeble prostatic micturition. | ... | ... | Unable to pass any voluntarily. | ... | ... | ... |
| Fenwick, London. | ... | British Med. Journ., Mar. 16, 1895. | 70 | 6 years. | ... | Yes. | ... | ... | ... | Small per rectum but by cystoscope the latera lobes are seen t project into th bladder, and th bar at the nec of the bladder i œdematous. |
| Fenwick, London | ... | British Med. Journ., Mar. 16, 1895. | 76 | Repeated attacks of retention and uræmia. | ... | ... | ... | ... | ... | Plump and elastic only moderatel enlarged towards rectum. |
| Fenwick, London. | ... | British Med. Journ., Mar. 16, 1895. | 76 | 5 years. | ... | Yes. | ... | ... | Catheter had to be used every hour. | ... |
| Fenwick. | ... | British Med. Journ., Mar. 16, 1895. | 81 | Several years. | ... | Yes. | ... | 9 years. | 6 or 7 times during night and 3 times during day. | Large and elastic especially th left lobe. |
| Fenwick, London. | ... | British Med. Journ., Mar. 16, 1895. | 60 | 2 or 3 years dysuria. | ... | Prostato-cystitis. | ... | Occasional use. | ... | Prostate large laterally and elastic |

| General Symptoms and Condition | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Result; Other Remarks. |
|---|---|---|---|
| . . . . . . . . . . . . . . . . | For two or three days after operation he passed a tablespoonful of urine several times a day. | Condition of urine improved, much less sediment and color much lighter. | In a month the prostate had reduced mo than one-third. Catheter discarded. |
| he prostatic condition complicated by spastic spinal paralysis, ankle clonus, spastic gait, weakness and shooting pains in the lower limbs, exaggerated tendon reflexes, and temperature changes. (Lateral sclerosis.) | Twelve hours after operation. | Urine was voided naturally. It has been unnecessary to use a catheter since (tenth day), if the patient was recumbent. In the erect position the urine passed naturally and easily. | May 24 (letter), patient is able to pass urine freely and without help,—lying, s ting, or standing. The third lobe h shrunken very much, and the body of t gland is reduced nearly to its normal si soft and still sensitive to the examini finger. |
| . . . . . . . . . . . . . . . . . . | About a week. | Dysuria was mitigated. | Jan. 19, hemiplegia occurred, and t patient died on the following day. |
| . . . . . . . . . . . . . . . . . . | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | Six days after operation acute mania dev oped, and death occurred on Jan. 13. |
| . . . . . . . . . . . . . . . . . . | | . . . . . . . . . . . . . . . . . | A week after operation the patient beca somewhat childish, mania appeared, a death occurred on the twelfth day af operation. |
| nlarged prostate with consequent distress. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | A few days after castration the patient hibited acute mania and died. |
| atient suffered all the distress attending an enlarged prostate, for which he had undergone much unsuccessful treatment at various hospitals. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | Thirty days after operation no psychi phenomena were observed; but there h been no mitigation in the urinary troul |
| pplied after ten years of skilled treatment for an aggravated prostatitis with great local pain, tenderness, and severe and intractable neuralgic radiations. Increased frequency of urination. Sitting or walking almost unbearable. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | Prostate slightly smaller, but no ot change as yet. Report too recent determine result. Patient reports t months later that he "considers him absolutely cured" (Brit. Med. Jour., M 11, 1895). |
| . . . . . . . . . . . . . . . . | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | Patient says he is "decidedly relieve (Brit. Med. Journ , May 11, 1895). |
| ntire genitals ablated for extensive epithelioma of the penis. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | After six months the prostate had been duced to the size of a small bean. |
| udden and prolonged retention, extreme difficulty in catheterization. Prostate unusually hard and enlarged, especially left lobe. | One week. | The patient began to void a little urine spontaneously, and in three weeks he was able to do without the catheter. | A later report says, "I have had no st page; the stream varies; sometimes i feeble, at other times there is high pr ure. Urinates sometimes every five six hours, at others every two or th hours. Improvement maintained." |
| light cysto-prostatitis with some mild pyelitis present. The inflammatory conditions began a year before the operation. | First week. | Urine cleared, the stream improved in force, and the pain diminished After three months the stream had markedly improved in force, and no symptoms remained except slight variability in the power of the bladder. | Improvement maintained. |
| Catheterization most difficult. Suprapubic drainage for months without improvement in the cystitis; double castration. | Cystitis rapidly diminished. | Voluntary micturition was recovered in a fortnight, prostate slightly smaller at end of third week. | Improvement maintained. |
| Dysuria, not much relieved by the catheter. Irrigations had no control over the cystitis. | Prostate slowly diminished in size. | Cystitis diminished, catheter needed only every six hours. | Active occupation renewed. |
| For past three months increasing difficulty in passing catheter, and the efforts were often followed by hæmorrhage. | For three days after operation, the catheter was needed only twice in twenty-four hours, then four times in same period. | At the end of three weeks, the prostate had slightly diminished in size, the cystitis had greatly decreased. The catheter still had to be used three times during the night. | . . . . . . . . . . . . . . . . |
| Intense pain after every attempt at urination; finally, retention. | Third day, voluntary micturition. | Slight shrinkage of prostate after two weeks. | Pain gradually left, frequency of urinat became normal, prostate still plump elastic; perhaps diminished one-eig by fourth week. |

| Operation. | Date of Operation. | Reference. | Age of Patient. | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization. | Estimated Size of Prostate before Operation. |
|---|---|---|---|---|---|---|---|---|---|---|
| Finney, Baltimore. | Sept. 22, 1894. | Johns Hopkins Hospital Bulletin, Dec., 1894. | 64 | 2 years. | . . . . . | . . . . . | 420 c.c. | . . . . . | Constant use of catheter. | Very much en larged. |
| Finney, Baltimore. | Very recently. | Johns Hopkins Hospital Bulletin, Dec., 1894. | 63 | 5 years. Unable to urinate for 2 years. | . . . . . | . . . . . | . . . . . | . . . . . | Frequent. | Much enlarged an very hard. |
| Fowler, New York. | Jan. 1895. | Personal communication, May 21, 1895. | 73 | 10 years. | . . . . . | . . . . . | 6 ozs. | Partially dependent upon catheter for 3 years. | . . . . . . | Moderate enlarge ment. |
| Fremont-Smith, St. Augustine. | Jan. 17, 1894. | Annals of Surgery, July, 1894. | 69 | 1 year. | . . . . . | Yes. | Smallest amount, 6 ozs. | . . . . . | . . . . . . | . . . . . . . . . |
| Gage, Worcester, Mass. | Jan. 18, 1895. | Personal communication, May 21, 1895. | 67 Farmer. | Entirely dependent upon catheter for 8 years. | . . . . . | Yes. | All. | 8 years. | Catheter used until Nov. last, every 3 hours; for last 2 months every 45 minutes, night and day. | Roughly, the siz of a large orange |
| Gage, Worcester, Mass. | Feb. 8, 1895. | Personal communication, May 21, 1895. | 67 Moulder. | Symptoms of prostatic obstruction for 3 years. | . . . . . | . . . . . | 6 ozs. | . . . . . | . . . . . . | Size of closed fist |
| Gavin, Boston. | Oct. 19, 1894. | Personal communication, May 2, 1895. | 69 | Frequent and scalding urination for 5 years. | . . . . . | . . . . . | Retention for 24 hours. Previously 5 ozs. residual urine. | 4 months. | Catheter had to be passed every 4 hours, day or night. | Size of a larg orange; dense smooth, sym metrically en larged; occlud ing the rectum t a considerabl degree. |

| General Symptoms and Condition. | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Resu Other Remarks. |
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| Inability to urinate and constant dribbling. Catheter withdrew four hundred and twenty cubic centimetres urine. Up to time of operation bladder was irrigated with boric acid solution without benefit. | Six days. | Urinated unassisted. Since this time has done well, barring one or two setbacks. Nov. 7, patient left hospital well. Prostate small and soft; no residual urine. | Patient put upon the regulation treat of washing out bladder and internal cation, but he was still unable to urine voluntarily. Five weeks after tion, lateral lobes just palpable soft, not tender, and show marked phy. Not more than fifty cubic cen tres (one and one-half to two ou residual urine. April 20, patient re- ined; "same condition as when charged,—well." |
| A false passage had been made by catheter, and the passage of an instrument was very difficult and painful; had retention and constant dribbling. | Fifth day. | Urinated spontaneously and without difficulty. The prostate diminished rapidly in size. | Patient died three weeks after ope from starvation. He was insane, a fused all nourishment. He had bee ject to temporary fits of insanity fo eral years. |
| Double orchitis in summer of 1894, with suppuration of left testicle and consequent multiple fistulæ. Compelled, after using catheter at bedtime, to rise three or four times during night to urinate. After operation, was catheterized every six hours for six days | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | Three months after operation the pr is reduced one-third in size, residual averages less than two drachms, he not rise at all at night, and he uri during the day about once in four h |
| Admitted to hospital Oct. 25, 1893. During the previous months, symptoms of increasing obstruction had set in. During seven and one-half weeks after admission he had irregular fever, urination was painful and frequent, especially at night; the urine was loaded with the products of decomposition and pus. Retention attacks were frequent. From Oct. 25 to Jan. 17, the usual and approved treatment, internally and by bladder douches, was carefully conducted by Drs. L. Alexander, A. Anderson, and the operator, but the patient steadily declined. Dr. J. William White saw him Jan. 1, and advised castration. The repeated attacks of acute cystitis, accompanied by increasing degrees of pus and septic fever, the harassing constancy of the desire to urinate, and the loss of appetite and sleep reduced the patient in seven and one-half weeks from one hundred and sixty-five to one hundred and thirty-five pounds. | One week. | During the week following the operation, the patient was catheterized twice daily, at the end of this time he voided urine naturally, and the catheter was used twice a week for the purpose of estimating the residual urine only. No local treatment was employed after the operation. March 1, patient was discharged. | After the castration there was no feve appetite returned, the weight incr from one hundred and thirty-five hundred and sixty-three pounds, an mental state, previously weak and ancholic, made decided improve There was no recurrence of the rete no cystitis, and the residual urine ished during the final week from to one and one-half fluidrachms. nocturnal desire to urinate was re from 12–15 to 4–6. The urine now sented a sediment only on standi hours, which contained under the scope a moderate number of pus May 2, 1894, a brother writes, "th tient's weight is one hundred and pounds; as to his water, he has no t at all, and no pain from that source. |
| Was able to sleep two hours consecutively but once in past month. Passage of catheter very painful, and often caused distressing erections. Had repeated hæmorrhages, becoming more frequent (now daily). Pain in bladder constant and severe Perineum so tender he could not sit squarely on chair. Capacity of bladder, two ounces, urine ammoniacal, and contained blood and pus. | Two weeks. | Cystitis lessened. | March 25, his physician reports, "Bu hæmorrhage since operation, can us catheter instead of one with stylet, passes with less pain and without tions. Sleeps from one to two hour less pain in perineum, and can sit and walk more easily; cystitis cured, and general condition is be The condition of this patient, an surroundings, absolutely precluded thought of drainage or prostatect and he refused to be removed. |
| For two years had passed urine every hour and a half, day and night. Jan. 27, acute retention. Feb. 3, passed some urine voluntarily, urine acid, no albumen. Feb. 4, complete retention again. | Third day. | Passed water freely without much effort, and has not used catheter since. Goes three to four hours without passing urine. | Recent report from patient states that perfectly well, so far as his control o nation is concerned. |
| The symptoms increased rapidly, and the constantly recurring pain demanded the use of the catheter more and more frequently, which was passed with difficulty. Came to hospital with distressing tenesmus, tremulousness, and prostration. Urine alkaline, and contained albumen and pus. | 8 hours. | The junior house officer was not called to catheterize the night following operation. The patient passed urine eight hours after the operation, for the first time in three weeks. After forty hours the catheter was no longer needed. Morphine was omitted, the patient passed urine without pain or tenesmus, one week after operation stitches removed, wounds healed, prostate much smaller and softer. In five weeks, prostate one-fifth former size, urine acid, less pus, residual urine three ounces; passes urine every four hours during day and two or three time at night, prostate one-sixth former size, urine clear. | The usual remedies had been tried wi any gain; in fact, the man was gro weaker. There is no question o great benefit he derived from the o tion. He has gained thirty pounds. |

| Operation. | Date of Operation. | Reference. | Age of Patient. | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization. | Estimated Size of Prostate before Operation. |
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| errat. | . . . . | Chirurg. Annalen., 1895, p. 97. (Russisch. Abstracted in Centralblatt f. Chirurgie, No. 16, 1895.) | 75 | . . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | Size of apple, equally enlarged on both sides. |
| id. | . . . . | Ibid. | 60 | . . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | . . . . . . . . |
| enn, Nashville. | May 16, 1894. | Personal communication, May 20, 1895. | 82 | 3 years. | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | Size of lemon. |
| alsted, Baltimore. | Nov. 27, 1894. | Personal communication, May 20, 1895. | 67 | 3 weeks. | . . . . . | . . . . . | 1000 c.c. | . . . . . | . . . . . . | Much enlarged and very hard. |
| alsted, Baltimore. | Mar. 23, 1895. | Personal communication, May 20, 1895. | 59 Colored. | Has bad dribbling of urine since Dec 1894. | . . . . . | Yes, severe. | . . . . . | . . . . . | . . . . . . | Enlarged. |
| alsted, Baltimore. | . . . . | Personal communication, May 20, 1895 | . . . | . . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | . . . . . . . . |
| alsted, Baltimore. | . . . . | Personal communication, May 20, 1895. | . . . | . . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | . . . . . . . . |
| ayden, New York. | Dec. 11, 1894. | New York Med. Rec., May 18, 1895. | 70 | 5 years ago began with frequent urination at night, and soon after in the daytime also. | . . . . . | Severe. | 4 ozs. Capacity of bladder, 6 ozs. | . . . . . | Urinated 5 or 6 times at night, and every half hour to hour during day. Drew off urine and irrigated bladder several times a day. | Prostate hard, smooth, and fully twice its normal size; pressure causes pain and intense desire to urinate. |
| aynes, Los Angeles. | Dec. 12, 1893. | Pacific Med. Journ., Oct., 1894. | Old. | . . . . . . | . . . . . | Chronic. | ½ pint. | . . . . . | Catheter 1 to 3 times daily. | Moderate hypertrophy. |
| Haynes, Los Angeles. | . . . . | Pacific Med. Journ., Oct., 1894. | Old. | . . . . . . | . . . . . | Intense degree. | . . . . . | . . . . . | Uses catheter every hour. | Extreme hypertrophy. |
| Haynes, Los Angeles. | . . . . | Pacific Med. Journ. Oct., 1894. | Old. | . . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | Incipient hypertrophy. |
| Haynes, Los Angeles. | Jan. 27, 1895. | Personal communication. | 62 | 6 years. | . . . . . | For 5 years. | . . . . . | 5 years. | Catheter had to be passed 11 times a day. | Large. |

| General Symptoms and Condition. | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Resul Other Remarks. |
|---|---|---|---|
| Entered hospital with retention. Emphysema of lungs, great atheroma of arteries, double hydrocele, and inguinal hernia. | Very soon after operation. | Two months after operation considerable decrease of prostate noted. | Operation under local anæsthesia. C tion always considerably better before operation. |
| Bladder punctured for complete retention. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | Complete cure resulted from the operat |
| Urinating in drops every hour. Very feeble, suffered severely. | Four days. | Four days after the operation the patient could urinate freely without the catheter. | Died May 24 Death not charged to c ation, as patient was nearly dead at of operation. The author believes operation three months earlier would cured him. |
| Admitted to hospital Nov. 17, 1894, with retention of urine. Frequent desire to urinate, and the day before admission the act was difficult and painful, only a few drops of urine could be passed at a time. Bladder large and sacculated. One thousand cubic centimetres of urine were withdrawn. | Dec. 3. | Voided urine naturally. Dec 15, 1894; patient discharged as well. Prostate much smaller and softer. | . . . . . . . . . . . . . . . . . |
| Admitted to hospital March 15, 1895, with incontinence of urine and phimosis, and enlarged prostate. | March 25. | Voided urine in a stream. Discharged April 15; improvement had been uninterrupted during the stay in hospital. Prostate diminished in size and much softer. | April 17, patient returned on account return of the bladder symptoms. He given irrigations of boric acid with g benefit. Patient passes his urine mally, but there is still some resi urine. |
| Desperate case, demanded immediate attempt at relief. Severe renal complications. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | Death due to failure of the renal func Autopsy showed stricture of the uret The prostate was riddled with sinu one of which communicated with the tum. There was a very marked cys and a double pyelonephrosis. Be death, it was necessary to perform a prapubic cystotomy. |
| Case desperate, pronounced nephritis, but the urgent prostatic symptoms would not permit of delay to carry out preparatory treatment | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | Death from nephritis, autopsy not al'o |
| Vesical and rectal tenesmus. Urine cloudy and ammoniacal. While straining to urinate the penis became congested and there was a partial erection. Each act of urination is attended with intense vesical and rectal tenesmus, and severe burning pain in prostate, urethra, and glans. Catheterization became very painful and almost impossible at times. Retention one year ago. Urine cloudy, alkaline, ammoniacal, pus one tenth by volume. Catheter draws urine at nine and one-half inches. No shock followed the operation. | Fifth day. | A small rubber catheter passed into the bladder, this had not been possible for many months. Urine clearer, and less tenesmus and pain. Tenth day, No. 18 F catheter passed readily. Gland softer and absolutely painless. Twentieth day, patient felt much improved, and passed his urine freely without the aid of the catheter. | Two months after operation the patie general condition was greatly impro he gained weight, and resumed his w Passed urine during the day at inter of from two to three hours, and, at ni three to five hours. Since operation, had no erections or sexual desire. hold the urine for half an hour after desire is felt. Residual urine, two oun The capacity of the bladder has ma ally increased April 9, patient is g ing more control over bladder. Ure measures eight and one-quarter in (March 17). Bladder now holds fif ounces. |
| Had not urinated with ease for two years. | . . . . . . . . . . | Shrinkage cf prostate; disappearance of cystitis. | After three months considers himself cu Urinates with ease, no cystitis, uses ca ter once in four days, to estimate resi urine (3 drachms). Prostates m smaller. Later, entirely well. March 1895, feels perfectly well, mind nor prostate normal, three or four erecti accompanied with sexual desire in five months. |
| Bedridden for three months. Passes no urine without catheter. Morphinist. | Sixteenth day. | Passes at least one-third urine naturally; catheter every six hours. | After two months is about his room. ( titis almost cured, catheter twice da Passes all the urine naturally, excep residuum of two ounces. Takes no r phine. Prostate greatly diminished. saved by operation. Later, patient suddenly from chronic renal suppurat At autopsy, prostate natural size. |
| Prostatic urethra so deformed it was almost impossible to pass catheter. | At end of three weeks. | Doing very well. | Patient entirely cured. |
| . . . . . . . . . . . . . . . . | . . . . . . . . . . | Decrease in size of prostate. | Wound healed by primary union. T weeks after operation uræmic sympt developed. A week later the patient in coma. The autopsy showed dila and suppurating kidneys and ureters pouched bladder. Prostate though have diminished in size one-quarter; about the size of a base-ball. |

| Operation. | Date of Operation. | Reference. | Age of Patient. | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization. | Estimated Size of Prostate before Operation. |
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| Horwitz, Philadelphia | Jan. 1, 1895. | Personal communication, May 21, 1895. | 67 Farmer. | 5 years. | Desire absent for past 6 years. | Yes. | . . . . . | 5 years. | Catheter used every hour or hour and a half. | Enormously enlarged, it quite filled up the rectum; the overgrowth was fibrous. |
| Horwitz, Philadelphia. | April 6, 1895. | Personal communication, May 24, 1895. | 70 Farmer. | 16 years. | None for 10 years. | . . . . . | . . . . . | Unable to pass urine without catheter for 6 years. | Catheter used every hour and a half. | . . . . . . . . . |
| Reported by Moullin before the Clinical Society of London. Case under the care of Dr. Houchin. | . . . . | British Med. Journ., May 4, 1894. | . . . | . . . . . . . | . . . . . | Repeated attacks. | All. | 15 months. | Used catheter every hour, day and night. | Exceedingly large |
| Hughes, Meriden, Conn. | Jan. 3 1895. | Personal communication. May 1, 1895. | 75 | 20 years. | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | Enlarged. |
| King, Toronto. | Dec. 26. 1894 | Personal communication, Jan. 9, 1895. | 73 | . . . . . . | . . . . . | Inordinate cystitis. | 4 ozs. | . . . . . | Catheter 3 or 4 times during night. | Apparently size o a small orange. |
| Frimann Koren and August Koren, Jr. | July 18, 1894. | N. Mag. f. Lægev., No. 1, 1895. | 66 | For one year had noticed failure in force of stream. | . . . . . | Present. | 1500 gm. | . . . . . | . . . . . . | 3 to 4 cm. high about 6 cm broad; not sen sitive. |
| Lichty. | Mar. 14 1895. | Personal communication. | 59 | 2 years. | . . . . . | Yes. | 2½ ozs. | . . . . . | . . . . . . | Size of lemon. |
| Lilienthal, New York. (See p. 16.) | Feb. 9, 1895. | New York Med. Rec., April 20, 1895. | 56 | 10 years. | . . . . . | Severe. | 4 to 6 ozs. | . . . . . | . . . . . . | About 3 times n o mal size. Well marked middl lobe. |
| McBurney, New York. | June 12, 1894. | Personal communication, Jan. 18, 1895. | 63 | 9 years. | . . . . . | . . . . . | . . . . . | . . . . . | Catheter used for 9 years from 7 to 10 times in 24 hours. | . . . . . . . . . |
| Mansell-Moullin, London. | July 5, 1894. | Med. Press & Circular, Sept. 19, 1894. | 81 | Some years. | . . . . . | Yes. | . . . . . | . . . . . | . . . . . . | Size of Tangerin orange. |
| Moullin, London. | . . . . | British Med. Journ., May 11, 1895. | . . . | . . . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | . . . . . . . . . |

| General Symptoms and Condition. | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Resu Other Remarks. |
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| Frequent desire to urinate, especially at night; this increased until the desire was almost constant. Had attacks of hæmaturia; urine thick and offensive. Patient thin and anæmic. The urine was alkaline, and contained albumen and an abundance of pus and phosphates. Operation consumed but a few moments, but there was considerable shock. A medium-sized rubber catheter could be passed with difficulty. | Twenty hours. | The patient passed his urine for the first time in five years without the use of the catheter. | Feb. 16, discharged cured. Desire tc urine much less frequent, does nc catheter, urine much clearer, and co less pus. Prostate one-half its f size. March 4, patient in perfect h Stronger than for years before. Do use catheter. Passes urine six tim twenty-four hours, is not disturbed at night, urine normal, no sign of ir mation of bladder. Prostate not dis ble to touch per rectum. Eighteen after being discharged (Feb. 16) i undergone almost complete atrophy |
| Frequent attacks of hæmaturia, two attacks of retention, and one of uræmia attended with convulsions, and narrowly escaped death. Patient thin and anæmic. No. 8 F hard rubber catheter passed with great difficulty, usually requiring five minutes for its insertion. Defecation greatly interfered with. Urine contained albumen, blood, phosphates, and casts. | Four days. | Catheter could be introduced much more easily. The prostate had diminished fully one-quarter as shown by rectal touch. April 11, urine passed without aid of catheter. The instrument could be passed without causing pain. April 14, urine passed without the use of catheter, urine much clearer, no blood, wound healed, dressings removed. Prostate but one-half its former size. | April 16, symptoms of uræmia devel and death occurred on the ninet from suppression of urine. The pr had shrivelled so as not to be detect the finger. A large-sized catheter be readily inserted without difficu pain. The urgent desire to pass had greatly diminished several day fore death. |
| Enormously stout man; occasional hæmaturia. No urine passed except by catheter for fifteen months. | . . . . . . . . . . . | On the ninth day, blood stained urine was passed spontaneously on several occasions. | The operation was well borne, and thing progressed favorably for a week was then seized with extreme dys which recurred again and again finally with hæmaturia and profuse rhœa, and death ensued on the ele day. At the necropsy the heart was soft and fatty, the kidneys (one espe cirrhotic, and all the abdominal and acic organs loaded with fat. The bl contained a calculus, concealed behi prostate; its walls were deeply con and ulcerated in places. The pro which was uniformly enlarged, wa and flabby, and there were eviden its recent diminution in size. |
| It finally became impossible to pass a catheter. | Seventh day. | Patient passed urine without a catheter, a thing he had not done for years. | On sixteenth, albumen appeared ir urine, and rapidly increased in ar until his death, Jan. 20. |
| . . . . . . . . . . . . . . . . . . | Twelve hours. | Patient had normal desire to urinate and did not wish catheter used. Catheter employed after this to estimate residual urine only. | The patient developed pneumonia o twenty-ninth, and died on the thir The residual urine had been reduc less than two ounces, and the pr had diminished to less than half its f size. |
| . . . . . . . . . . . . . . . . . . | Aug. 2, urinated spontaneously. Nov. 11, prostate diminished to two centimetres, and did not protrude in rectum. | On seventh day some softening of the prostate was noticed, and a decrease in its size 3 x 4 centimetres. | "The hypertrophy of the prostate, w its symptoms, has disappeared. Tl tient rises but once at night to urina |
| Frequent and difficult micturition, left lobe being the larger. Urine foul, very alkaline, and contained pus and mucus. The patient was treated for the cystitis by internal remedies and daily irrigations of boric acid solution. There was no improvement at the end of three weeks. | . . . . . . . . . . . | Able to urinate with greater ease; residual urine, one-half ounce. | Chloroform anæsthesia, stitches remov eighth day. Perfect union. Twelft after operation temperature rose, s toms of uræmia developed, and occurred on the fifteenth day. death, prostate found to be about ha former size. The condition of the ki was fully appreciated by the operato patient before operation, but the ma sisted on the operation, as his di was too great to bear. |
| Constant pain and an urgent desire to urinate at least once an hour during night. In daytime, every five to fifteen minutes. For six weeks he had been treated with vesical irrigations and internal remedies. | Slight remission in first twenty-four hours; fifth day, miraculous improvement. | Cystitis diminished, and passed full stream, one ounce residual urine. | Prostate flaccid and one-half former s |
| Suppurative disease of both testicles, great prostatic enlargement, and great interference with urination. Lost sixty pounds. | Within two weeks. | Catheterization very much easier, urine has cleared, there is no longer any distress, the patient passes a few ounces (three) of urine voluntarily, and uses the catheter two or three times in twenty-four hours. | Fifty pounds of flesh have been rega Jan. 18, 1895, patient in robust h Has no annoyance from difficulty ir nation, although he still retains a po of it. "Upon my advice uses ca two or three times a day." |
| Catheter could not be introduced. | Next day the urine came more freely. | Tenth day after operation the prostate was much smaller. Three weeks after it had disappeared. | The bladder was beginning to regain p The urine had become acid. An ord silver catheter passed in easily, wi requiring to be depressed more usual. |
| . . . . . . . . . . . . . . . . . . | . . . . . . . . . . . | . . . . . . . . . . . . . . . . . . | Referred to ten cases not previousl ported. The cases did well, and ar suffering in any way from mental tro |

| Operation. | Date of Opera-tion. | Reference. | Age of Patient | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization. | Estimated Size of Prostate before Operation. |
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| ırks, Milwaukee. Reported by Andrews. | . . . . | Tri-State Med. Journ., Mar. 1895. | 59 | . . . . . . | . . . . . | Chronic. | . . . . . | . . . . . | . . . . . | Enlarged. |
| ırtin, Philadelphia | Nov. 9, 1894. | Personal communication, May 22, 1895. | 68 | 10 years. | Lost. | Yes. | All. | 80 days. | . . . . | Size of half an orange, filling the rectum and preventing the examining finger from reaching the bladder wall. |
| eyer & Haenel, Dresden. | May 16, 1894. | Centralb f. die Krankheiten der Harn und Sexual Organe, Bd. v, Heft 7, 1894. | 70 | Some time. | . . . . . | Present, urine ammoniacal. | 120 to 150 c.cm. | . . . . | . . . . . | Evenly enlarged and about size of fist. |
| ıckard. Philadelphia. | Nov. 25, 1894. | Personal communication, May 27, 1895. | 70 | 2 or more years. | . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . |
| ercy, Placerville, Cal. | Aug. 8, 1894. | Med. Rec., Feb. 23, 1895. | 71 | . . . . . . | . . . . | . . . . . | . . . . . | . . . . . | . . . . . | Prostate immensely enlarged. |
| lcher, Brooklyn. | Jan. 19, 1895. | Personal communication, May 25, 1895 | 74 | For 20 years had frequent urination. | . . . . . | . . . . . | . . . . . | . . . | . . . . . | Marked enlargement. |
| owell, Bengal. | 1887. | British Med. Journ., Nov. 8, 1893. | 65 | For months had had retention of urine. | Not given. | Not mentioned. | Not given. | Months. | Not given. | Not given. |
| ımm, Christiania. | April 3, 1893. | Centralb. f. Chirurgie, Sept. 2, 1893 | 73 | 15 years. | Not given. | Not mentioned. | Not given. | Catheter had not been used. | Hourly urination. | Small orange. |
| ımm, Christiania. | April 25, 1893. | Centralb. f. Chirurgie, April 28, 1894. | 67½ | 14 years. | Not given | Present for 1 year. | Not given. | 7 years. | Sometimes used catheter 2 or 3 times hourly. | Very large; upper border could only just be reached by the finger in the rectum. |

| General Symptoms and Condition. | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Resu Other Remarks. |
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| Had disease of both testes. | . . . . . . . . . . . | After several weeks the cystitis was greatly benefited. | Testicles removed for their conditior not with any idea of influencing con of prostate and bladder. |
| Urination most frequent between the early morning hours and noon. For three years has urinated every half-hour during night. Suffered great pain at each act of urination General failure of health for three months before coming under reporter's care. Often rises twenty times during the night. For eighty days there was complete retention with overflow. Catheter always gave great pain, and at times could not be passed. Blood often followed the passage of the instrument. Urine ammoniacal, and contained large quantities of pus and mucus. At time of operation, temperature, $100\frac{3}{5}^{\circ}$, pulse, 89 and feeble. Mental hebetude, wandering delirium at times. The patient was emaciated and rapidly losing ground. | Fourth day. | Passed three ounces of urine. Fifth day, four ounces, temperature normal, pulse 74. Sixth day, passed ten ounces urine; from this time on the improvement was progressive. He suffered no pain from the time of operation, passed no blood, and there was a marked diminution in the amount of pus in the urine. | Forty days after operation there ar ounces of residual urine, which stil tains pus. He has gained t pounds, and says he is as well and s as ever; he passes a good stream of without pain or irritation. Rises at to urinate two or three times, and p urine four or five times during the He never uses a catheter. |
| Great tenesmus during urination, fever, insomnia. Cystitis had been treated with vesical irrigations, but introduction of catheter caused great pain. | Few days after operation tenesmus had nearly gone, and catheter could be introduced with ease. | May 24, some diminution in size of prostate. May 31, had diminished one-third. July 3, two-thirds smaller. July 25, almost normal in size. After fourteen days, contractile power of detrusor muscle began to return. | July 25, the following note is made prostate is about normal in size, the can be retained four or five hours, ar bladder can be completely emptied out the use of instruments. The can be projected from the penis ir normal curve, and there is no dribbl |
| Urinating every one to three hours. | . . . . . . . . . . . | At first prolongation of intervals; general improvement; patient now thinks the intervals are getting smaller. | The patient complains of "flashes" si to those occurring in women at the n pause. No examination recently. |
| Occasional retention, becoming more frequent. Very difficult to pass catheter. | Day following passed urine more freely than before. | After two weeks he had no further trouble passing water. | Two months after operation prostate diminished to one-half its former siz |
| First seen by Dr. Pilcher, Jan. 18, 1895. At this time bladder was distended and reached four inches above umbilicus; dribbling every few minutes, had existed some weeks. Catheter could not be passed. | Fifth day. | A catheter was passed easily and the urine drawn every eight hours, as the prolonged overdistention had so paralyzed the bladder that voluntary evacuation was not to be expected. | During the chloroform anæsthesia, e were again made to pass a catheter without success. There was no syst disturbance. Patient has quite recov is able most of the time to urinate wi the use of the catheter. Attends to ness pretty regularly. May 25 (le by rectal touch, the prostate appear diminished in size since before the o tion, he uses a catheter every three l with ease and comfort, is able to about one ounce of urine at a time can, by occasionally voiding this am go six hours without using the cath when eight or ten ounces will be drawn. The paralysis from overdiste present at the time of operation has recovered from, and he thinks his al spontaneously to void urine is increa His general health has greatly impro and is now excellent. |
| Retention of urine requiring visits to out-patient department of hospital. | Not given. | Rectal examination showed marked diminution in the size of the prostate. | Left testicle small and useless; right tes removed for a "nodule." Three mo later no urinary symptoms. |
| Complete retention at time of admission to the hospital. | Three days. | Prostate was distinctly smaller. | Twelve days after prostate was a " mass. After the operation, and du the first two months, the catheter passed three or four times to relieve porary retention. A year later he pa urine normally; only emptied bla twice during night. |
| Catheterism very difficult. Bladder distended, reaching to the umbilicus. | The night after the operation. In eleven days. Six weeks. | Patient passed about eighty cubic centimetres of water. Prostate was distinctly smaller. Could pass a good stream. | One year later prostate was a small, mass, with a median ridge in positic urethra. He passed water four to times only in the day, once at n always without difficulty. The cy had disappeared. |

| Operation. | Date of Operation. | Reference. | Age of Patient. | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization | Estimated Size of Prostate before Operation. |
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| amm, Tromso. | July 10, 1894. | N. Mag. for Lægv. LVI t., p. 28-32. Abstracted in Revue Internationale de Médecine et de Chirurgie pratique, April 10, 1895. | 57 | For 10 years had retention more or less, and great inconvenience. | . . . . . | Yes. | . . . . . | . . . . . | . . . . . . | . . . . . . . . . . |
| and, Brooklyn. | May 18, 1895. | Personal communication, May 26, 1895. | 69 | Frequent urination for the past 9 years, most marked at night. | . . . . . | . . . . . | 4 ozs. | . . . . . | . . . . . . | At least double the normal size, moderate enlargement of the median portion. |
| and, Brooklyn. | Feb. 24, 1895. | Annals of Surgery, June, 1895. | 58 | More or less difficulty in urinating for 10 or 12 years. | . . . . . | . . . . . | 5½ ozs. | . . . . . | . . . . . . | Enlargement of the median lobe prevented passing Thompson's searcher; lateral lobes moderately enlarged, the right, more than the left. |
| and, Brooklyn. | . . . . | Annals of Surgery, June, 1895. | 65 | . . . . . . | . . . . . | Yes, tuberculous. | None. | . . . . . | . . . . . . | . . . . . . . . . . |
| cketts, Cincinnati. | Oct. 26, 1894. | Times & Register, Phila., 1894. Personal communication, May 18, 1895 | 74 | . . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | Urinated about 30 times daily, hourly at night. | . . . . . . . . . |
| itzin, Moscow. | 1894. | Lyon Médical, May 27, 1894. | 75 | 9 years. | Extinct for 9 years. | . . . . . | . . . . . | Not given. | . . . . . . | . . . . . . . . . . |
| ith, Norwich, Conn. | Mar. 29, 1895. | Personal communication, May 4, 1895. | 80 | Several years. | . . . . . | Yes. | . . . . . | . . . . . | Catheter. | Fearful condition, odor of breath and body that of decomposing urine. |
| uchon, New Orleans. | Mar. 4, 1895. | Personal communication, May 1, 1895. | 63 | 4 years. | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | Half the size of a small orange. |

| General Symptoms and Condition. | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Result; Other Remarks. |
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| ame under operator's care July 9, 1894, for retention. The bladder reached nearly to the umbilicus. The prostate protruded symmetrically into the rectum; it was smooth and slightly hard. The patient had a painful cystitis. The bladder was irrigated regularly with boric acid solution, sodium bicarbonate, or silver nitrate, with evident benefit. | . . . . . . . . . . | The patient left the reporter's care Aug. 23. At this time he did not urinate more frequently than from one to three times at night, and three or four times in the daytime. The amount of residual urine varied from one to three ounces. On some days the urine is clear, at other times it contains pus and mucus. The prostate had diminished in volume, and was very much flattened. | Dec. 10, since the last report, the pati has never experienced difficulty in ui ating. He has been exposed in his oc pation as a gardener to rain, snow, a cold. He has had, however, mild, tr sient attacks of cystitis. The urine clear, acid in reaction, and the spec gravity is 1016. The prostate remains a flattened mass. |
| or some months prior to operation patient had urinated three or four times at night, and during the two or three years previous to operation every half-hour or hour, and always with pain and straining. Has lost weight and suffers from loss of sleep. Both testicles showed cystic degeneration. Temperature had been from 100° to 101°. | Five days. | Slept all night, some seven hours; the first time in months he had been able to pass through the night without being obliged to urinate. Urination diminished in frequency, less straining. | The day after operation the temperat fell to 99$\frac{2}{5}$° F, and was normal after next day. No shock or pain followed operation. May 19, 11 A.M., resid urine three ounces. During the n two days the pain and frequency of uri tion diminished May 22, after th hours without urination, fourteen oun of urine were withdrawn, showing an crease in tolerance of the bladder. M 26, slept five hours at one time last nig straining diminished more than one-h and better every way. Prostate m smaller. |
| or several years he has had more or less incontinence, and for two years nearly constant dribbling. Has been treated at different hospitals during past year for enlarged prostate without any relief There was great difficulty in passing catheter; as a rule, nothing would enter but a prostatic catheter. Length of urethra, eight and one-half inches. | Second day. | Voided twelve ounces of urine voluntarily, and with much less straining than he had been accustomed to. Six days after operation there was one-half ounce of residual urine; the next day, none, although a little remained at times during the following week. March 17, appreciable diminution in the lateral lobes,—a sound passed into the bladder as though the former obstruction had been largely removed. | April 5, there has been continuous impro ment in the local symptoms. The ur passes naturally, without straining. sidual urine generally absent; if prese but an ounce or less. The interval tween the acts of urination is grow longer. Length of urethra, seven a one-half inches. Prostate much smal and a small-sized sound drops in bladder by its own weight. |
| he patient came under Dr. Rand's care a few months after having had his testicles removed for tuberculosis. At this time the prostate was slightly nodular, but there was no general enlargement of the lateral lobes, and no evidence of enlargement of the median portion. The urethra was not lengthened, and there was no residual urine He had frequent and painful urination, and later, tubercle bacilli were found in the urine. The patient made the statement that after the removal of his testicles he had much less difficulty in passing urine than formerly, but the significance of this remark was not appreciated at that time. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . | As attention had not been called to this s ject at that time, a close study of the s sequent course of the patient was made. The following, however, se worth noting: the small size of the gla though tubercular, and his statement regard to urination, coupled with his a He lived nearly four years after com under Dr. Rand's care, and died fr tuberculosis of the bladder and kidne His prostate did not increase in size, a he never had residual urine. |
| Condition pitiable.'' Had severe pain. Could not obtain sleep. No kind of medication seemed to give relief. Could not pass catheter. | Second day. | Said he could urinate with greater ease, and that pain was less. Could sleep four hours at night; formerly had to urinate every hour. | Left hospital on sixth day, during wh time the improvement was constant. J 22, 1895, no obstruction, straining, or vere pain. Still passes urine too quently, and has some burning and itch after micturition. Patient practically w |
| ot given. | Two to three months. | Considerable diminution in size of prostate. | A year later all traces of hypertrophy disappeared. |
| lood followed catheter every time. Had not passed urine for seven years. | Forty-eight hours. | Catheter passed readily and blood disappeared. | No other treatment was employed. Sle all night, passes catheter every ten twelve hours. |
| . . . . . . . . . . . . . . . | Fourth day. | Was able to pass a small quantity of urine through the urethra by closing the suprapubic opening with the finger. At end of a week and a half there was appreciable reduction in the size of the prostate, it was also softer. | The patient was aspirated four years bef the castration for retention, after fail to pass catheter. Oct. 27, 1894, patier condition desperate. Suprapubic cyst omy was performed. The middle lobe the prostate was found much hypert phied; this was excised, and the blad drained. The patient still obliged to p catheter after wound healed. A sm fistula, however, remained. Feb. 23, 18 the patient returned for treatment, as was unable to pass the catheter a longer. On April 13, the patient v seen, and he passed a stream as large an ordinary goose-quill, but he still u catheter to thoroughly empty it, and the purpose of irrigation. April 15, patient died suddenly, of super-ac pulmonary trouble. |

| Operation. | Date of Operation. | Reference. | Age of Patient. | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization. | Estimated Size of Prostate before Operation. |
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| Spencer, Brandon, Mass. | Mar. 30, 1895. | Personal communication, May 4, 1895. | 64 | Several months. | . . . . . | Yes. | . . . . . | . . . . . | . . . . . . | Medium-sized orange; left lobe larger and harder than right. |
| Steinbach, Philadelphia. | April 23, 1895. | Personal communication, May 22, 1895. | 72 | Has suffered intermittently for the past 12 years from retention on account of enlargement of the prostate. | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | . . . . . . . . . |
| Stimson, New York. | Jan., 1894. | Personal communication, Jan. 8, 1895. | 75 | A long time. | . . . . . | . . . . . | . . . . . | . . . . . | Urine passed exclusively (?) by catheter at frequent intervals. | . . . . . . . . . |
| Stretton, London. | Jan. 15, 1895. | Lancet, Mar. 2, 1895. | 60 | Some months. | . . . . . | . . . . . | . . . . . | 6 weeks. | . . . . . . | As large as a hen's egg. |
| Thayer, Waterville, Me | May 12, 1895. | Personal communication, May 24, 1895. | 74 | 8 years. | . . . . . | Yes. | All capacity of bladder 6 ozs. | 3 years no urine passed except by catheter. | Catheter used about every 4 hours; its introduction is painful. | Markedly hypertrophied, very tender and dense, median lobe most enlarged. |
| J. D. Thomas, Pittsburg. | . . . . | Pittsburg Med. Review, Dec., 1894. | 65 | 15 years. | . . . . . | . . . . . | . . . . . | . . . . . | Urination very frequent. | . . . . . . . . . |
| Thomas, Pittsburg. | Aug. 5, 1894. | Pittsburg Med. Review, Dec., 1894. | 60 | 10 years. | Virile powers lost for several years. | . . . . . | . . . . . | Tried use of catheter, but gave it up because so painful. | . . . . . . | Both lobes uniformly and considerably enlarged. |
| Thomas, Pittsburg. | . . . . | Personal communication, May 24, 1895. | 76 | Several years. | . . . . . | . . . . . | . . . . . | 2 years. | Used catheter every half hour or hour. | 3 times normal size. |
| Tupper, Bay City, Mich Reported by Walker. | 1877. | New York Med. Journ., April 20, 1895. | 56 | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | Used catheter daily or oftener. | Very large. |
| Tupper, Bay City, Mich. Reported by Walker. | 1882. | New York Med. Journ., April 20, 1895. | 59 | Several years. | . . . . . | . . . . . | . . . . . | Considerable period. | . . . . . . | . . . . . . . . . |
| Tupper, Bay City, Mich. Reported by Walker. | 1886. | New York Med. Journ., April 20, 1895. | 58 | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | Frequent use of catheter. | Very large. |
| Reported by Tupper to Walker. | Over 10 years ago. | New York Med. Journ., April 20, 1895. | Old. | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | . . . . . . . . . |

| eneral Symptoms and Condition. | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Result ; Other Remarks. |
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| equent micturition, lack of force in stream, health broken down. Urine alkaline. | . . . . . . . . . | The urine became acid. Incontinence of urine, attributed to paresis of sphincter muscle. Health improved, pains gone, sleeps without difficulty. | Prostate reduced to nearly normal siz Left lobe now smaller of the two (Ap 30). |
| ie patient employed a soft rubber catheter, and at times required the aid of a physician, who occasionally experienced much difficulty in introducing the instrument. In April it was necessary to perform suprapubic puncture to relieve the retention. This was followed by a precystic abscess, which was evacuated through the bladder. Both testicles were removed, and at the same time a large left inguinal entero-epiplocele was operated upon. A small hernia on the right side was left undisturbed. | Second day. | On the day after the operation twenty-two ounces of urine were drawn off. Since that time the patient voids urine unaided and without any difficulty. | He left the hospital one week after t operation. |
| istration for chronic non-tubercular inflammation of both testes. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . . | Holds the urine for several hours; ris only once at night. He has discarded t catheter. |
| ad not passed any urine except by catheter for six weeks. Urine contained pus and *débris*. | Ten days. | Passed urine spontaneously. 28th, passed eight ounces at one time. The bladder was washed out three times a day, but the urine still contained pus, and the catheter was needed. The prostate was reduced to one-half its former size. The right testicle was found to be tuberculous. | When discharged from the hospital, Fe 20, 1895, the patient was able to wa about, his urine was clear, and w passed naturally, A few days later again became delirious, and, although partially recovered, he relapsed again ar died from exhaustion. The operation ha materially reduced the size of the prc tate, and restored the power of mictu tion. Had it been done earlier, it wou probably have prolonged his life (Lance April 27, 1895). |
| nsiderable pain in perineum and glans penis, causing him to grasp the latter tightly a great part of the time. Has strong erections and a decided sexual desire, which he has not gratified. For three months has taken from a quarter to a half grain of morphine daily. Urine cloudy, ammoniacal, and contains albumen. Catheter passed nine and one-half inches before drawing urine. | Seventh day. | The pain had somewhat decreased The pain in the glans is greatly lessened. Catheter draws urine at nine inches, prostate softer and less tender. The morphine was withdrawn, which caused some depression and an exhausting diarrhœa. | No shock followed the operation. May (twelfth day), patient expresses himself feeling decidedly better. The attacks pain are much less frequent, and the ir tation of the penis is decidedly lessene and he scarcely touches it. The prosta has markedly decreased in size, and the is scarcely any tenderness. |
| . . . . . . . . . . . . . . . . | . . . . . . . . . . | . . . . . . . . . . . . . . . . | Is now obliged to urinate but three times day. |
| ine came by drops and with severe straining. | A few days. | Improvement in function of urination. Retains urine two to six hours in day, and two hours at night. Marked decrease in size of prostate. | Improvement kept up. The double castr tion was done for tuberculous disease testicles. |
| improvement followed rest in the recumbent position and irrigation of the bladder. Urine loaded with pus. No propulsive power in bladder. Frequent attacks of epididymitis. | It has not been necessary to use catheter since operation. | . . . . . . . . . . . . . . . . | Now urinates every three hours during th day, and three or four times at nigh always without pain. Prostate diminishe more than one-third in size; the uri contains very little pus. |
| larged and painful right testicle, frequent and painful micturition. Left testicle removed more than a year previously for supposed malignancy. | Few days. | By the time the wound had healed, all the bladder symptoms had disappeared. | In a personal interview some years later said he had no further trouble with mict rition. The removal of the left testic had improved his micturition material for several months, but the previous sym toms gradually returned, with greater i tensity than before, and he decided have the right one removed. |
| inful testicles and persistent desire o urinate. Bladder had been aspirated for retention. | Second day. | Could pass urine without the catheter. In about two weeks but little bladder irritation remained. | Six months after the operation he said could urinate as well as ever, and could enjoy intercourse more satisfactori than for six years past. |
| rsistent and exquisite pain in testicles of ten years' duration, irritable bladder. Both testicles enlarged and sensitive. | Three weeks. | Entire relief from pain, and freedom from all bladder trouble. | . . . . . . . . . . . . . . . . . . . . |
| stressing bladder condition due to enlargement of prostate. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . . | This patient was confined, on account of mania for exposing his person on imprope occasions. He was castrated with a vie to curing the mania. It "cured both th brain and the bladder troubles." |

| Operation. | Date of Operation. | Reference. | Age of Patient. | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization. | Estimated Size of Prostate befor Operation. |
|---|---|---|---|---|---|---|---|---|---|---|
| Van Pelt, Toledo, O. | May 11, 1895. | Personal communication, May 24, 1895. | . . . | . . . . . . | . . . . . | Yes. | . . . . . | . . . . . | . . . . . . | . . . . . . . . |
| Walker, Detroit. | Jan. 23, 1895. | New York Med. Journ., April 20, 1895. | 65 | 8 years. | . . . . . | Yes. | . . . . . | Over a year. | . . . . . . | . . . . . . . . |
| Walker, Detroit. | Feb. 6, 1895. | New York Med. Journ., April 20, 1895. | 71 | 15 years. | . . . . . | Yes. | 2 to 3 ozs. | . . . . . | Desire to urinate every 5 minutes to 1½ hours. Uses catheter. | Very much e larged, with median bar. |
| Walker, Detroit. | Feb. 26, 1895. | New York Med. Journ., April 20, 1895. | 63 | 7 years. | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | . . . . . . . . |
| Warren, Boston. | Nov. 24, 1895. | Personal communication, May 1, 1895. | 65 | 9 or 10 years. | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . . | Much enlarged, e tending from o side of pelvis the other, and u per border cou not be reache by finger. |
| Warren, Boston. | Dec. 22, 1894. | Personal communication, May 1, 1895. | 64 | 6 years. | . . . . . | . . . . . | . . . . . | Nearly 6 years. | Catheter more and more frequently, and several times at night. | Right lobe co siderably e larged, remai der slightly e larged. |
| Watson, Boston. | Jan. 3, 1895. | Boston Med. and Surg. Journ., April 18, 1895. | 58 | Several years. Retention 1 year ago, and again 3 months ago. | . . . . . | Yes. | Could pass but 1 oz. of urine spontaneously. | 3 months. | Voided a few drops of urine every 15 minutes or so. | Upper border cou not be felt b finger in rectu both lateral lob markedly hype trophied and ve dense and har right more so. |
| Watson. | Jan. 21, 1895. | Boston Med. and Surg. Journ., April 18, 1895. | 69 | Symptoms of obstruction for 3 years. | . . . . . | . . . . . | . . . . . | 1 year. | Had to be catheterized regularly. | Moderate hype trophy of later lobes. Cathet passed 9½ inch before drawi urine. |
| Watson, Boston. | Feb. 21, 1895. | Boston Med and Surg. Journ., April 18, 1895. | 70 | Several years. Overflow of bladder for several months. | . . . . . | Yes. | . . . . . | . . . . . | Constant and painful desire to urinate, at times violent tenesmus, frequent dribbling. | Much enlarged. |
| White, Philadelphia. | Jan. 13, 1895. | Philadelphia Hospital. | 82 | Increasing difficulty in urinating for 3 years. | . . . . . | Yes. | Retention. | . . . . | . . . . . | Greatly enlarged. |

| General Symptoms and Condition. | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Result Other Remarks. |
|---|---|---|---|
| Urine contains mucus, pus, and epithelium. | . . . . . . . . . . | Thirteen days after operation the prostate is only one-half its former size. | Operation: fistulous tract in perin opened, and three calculi—two as la as walnuts, and one the size of a hick nut—were removed. The bladder then injected with one ounce silver nit solution, thirty grains to one fl ounce, and afterwards flushed out. testicles were then removed. Condi verified by two medical friends. |
| All the symptoms of an aggravated cystitis. Frequent desire to urinate. | Third day. | Could retain his urine from three to five hours. On eighth day the use of the catheter was discarded, the urine was clear, and retained six to nine hours. Prostate diminished appreciably in size. | Letter in the latter part of March states he is not cognizant of any difficulty passing urine. The cystitis, which very bad, has entirely disappeared. |
| Usual cystic symptoms. | Within a week. | Held the urine one time nine and one-half hours. After getting about, the improvement was not so marked, and at times uses a catheter. | Examination of the urine shows a mani betterment in its condition. |
| Four years ago the writer removed a pedunculated median growth by perineal cystotomy, but the old symptoms of obstruction returned. | . . . . . . . . . . | Left operator's care in two weeks with decided abatement of his bladder symptoms. | Letter dated March 29, 1895, says, "T is but little pus in the urine, entire sidence of pain, urinates but about in four hours, and does not have to u catheter." |
| Came into hospital with retention. Had been aspirated three times. | Three days. | Nov. 28, instrument appeared to pass more easily. Patient able to urinate for the first time since Nov. 5. | Attempts were made for two weeks to k a flexible catheter in the bladder, bu was passed with difficulty, owing t false passage. The patient continue pass increasing amounts of urine. Ja marked diminution in size of pros (confirmed by Dr. Beach). |
| . . . . . . . . . . . . . . . | . . . . . . . . | . . . . . . . . . . . . . . . . . . | Jan 12, 1895, much less smarting, and intervals of catheterization had increa to four hours. There was no mar change in the size of prostate. |
| Painful desire to urinate every fifteen minutes, day and night. Symptoms seemed aggravated by use of catheter. | Thirty-six hours. Had an interval of one and one-half hours without pain or desire to urinate. Second night, after operation, slept undisturbed for two hours. | Sixth day passed from two to four ounces urine spontaneously, pain decreased. Tenth day, free from pain, and urine contained less blood and pus. Three weeks later but one and one-half ounces residual urine, which was almost free from pus; distinct diminution in size and hardness of prostate. | Two months after operation the pros was smaller than normal, there was one ounce of clear, residual urine. patient slept five hours at a time ur turbed. Urinated in the daytime e three or four hours. Patient felt ten y younger, and worked at his trade (st cutter) as hard as ever. |
| Could pass but a few drops of urine at a time spontaneously. Urine contained considerable pus. | . . . . . . . . . . | . . . . . . . . . . . . . . . . . . | Forty-four days after operation there been no perceptible change in patie condition, save a diminution in amount of pain. |
| Admitted to hospital with retention. Patient beginning to be uræmic. Condition critical. | Third day. | Decided relief of bladder tenesmus and pain. | Patient had double inguinal herniæ of standing, which were operated upo time of castration. Patient was delir before operation, and continued so. I ing night following operation, the pat got out of bed, tore off the bandages, forced down the herniæ. His uræ condition became worse, and he died ninth day. Examination of testicle time of operation showed spermatozo be absent. At the autopsy, marked largement of the prostate (fibro-adeno tous) was observed. There were spermatozoa in the vesiculæ semina There was extensive pyelonephritis both kidneys. |
| Stream slow in starting. Urinates ten times a night and with difficulty. Urine cloudy and foul. Six days before admission, complete retention. On admission, retention and delirium, alternating with stupor; general condition profoundly adynamic. No instrument could be passed, so bladder was aspirated above pubes, and sixteen ounces of decomposed urine withdrawn; albumen and casts. | Twenty-four hours. | Doubtful decrease in size of prostate, as felt per rectum. | Operation completed in three and one- minutes. Patient reacted well, but delirium deepened, and he died on evening of the second day in coma ( mia). The prostate was smaller before operation. Microscopic sec showed in the stroma of the gland ginning proliferation of the connec tissue cells The acini tubules are becoming filled with proliferated colun cells, and here and there some fine g ular matter may be seen in the tubu Some of the cells appear to be filled fine granules, which have not taken stain, evidently fat. The changes typical of beginning atrophy. |

| Operation. | Date of Operation. | Reference. | Age of Patient. | Duration of Symptoms Previous to Operation. | Condition of Patient as to Sexual Power. | Cystitis. | Residual Urine. | Duration of Use of Catheter. | Frequency of Urination or of Catheterization. | Estimated Size of Prostate befor Operation. |
|---|---|---|---|---|---|---|---|---|---|---|
| White, Philadelphia. | Jan. 26, 1895. | Philadelphia Hospital. | 79 | 8 years. | . . . . . | Yes. | 6 ozs. | . . . . . | Catheterized 4 to 6 times daily. | Prostate size of a orange. |
| White, Philadelphia. | Dec 12, 1894. | University Hospital. | 60 | 18 months. | . . . . . | Yes. | 6 ozs. | Had used catheter for years. | Urinated hourly. | Size of small o ange. |
| White, Philadelphia. (See p. 25.) | Mar. 12, 1895. | Private patient, University Hospital. | 74 | Several years. | . . . . . | Yes. | 4 ozs. | 5 years. | Urinated every hour or two. | About 3 times nor mal size. |
| White, Philadelphia. | May 18, 1895. | German Hospital. | 82 | Several years. | . . . . . | Yes. | All. | Passed no urine without the use of catheter for several years. Catheter passed 10 inches before drawing urine. | Catheter had to be passed every 4 to 6 hours. | Size of large lemon The finger coul barely reach th upper margin. |
| White, Philadelphia. | Jan. 31, 1894. | Medical News, June 2, 1894. | 69 | 12 years. | Extinct for some years. | Present and marked. | Complete retention. | Many years. | 6 to 12 times daily. | Half the size of a orange. |
| Worthington, Los Angeles. | . . . . | Personal communication, Mar. 12, 1895. | 65 | 6 years. | . . . . . | Chronic. | . . . . . | . . . . . | . . . . . . | Enlarged. |
| Worthington, Los Angeles. | . . . . | Personal communication, Mar. 12, 1895. | 70 | . . . . . . | . . . . . | Chronic. | . . . . . | . . . . . | . . . . . . | Enlarged. |

| eneral Symptoms and Condition. | Time at which First Improvement was Noticed. | Character of Improvement. | Subsequent Course and Final Result; Other Remarks. |
|---|---|---|---|
| inated five or six times at night. ccasional complete retention rine cloudy, contains albumen, us, and mucus. | Three days. | Incontinence replaced retention. | Operation completed in four minutes. Apr 1, incontinence has ceased; empties bla der only about five times daily; prosta greatly reduced. May 2, no return urinary troubles. Urine clear. |
| equent urination accompanied with istress; loss of sleep due to frequent calls to urinate; the urine ontained albumen, pus, and mucus. The patient was put to bed two weeks, salol and boric acid were iven internally, and the bladder rrigated night and morning with ilver nitrate solution, 1 : 6000, with ut slight improvement. Patient eft hospital and returned to work, ut applied for admission again Dec. 5, 1894, with the symptoms much aggravated. Urinating every hour. | Twenty-four hours. | Urinated only eight times in the twenty-four hours following operation. He said the urine passed much more freely than before operation, and he had less pain in bladder Dec. 15, albumen, pus, and mucus diminishing in quantity in the urine. Urinated five times in twenty-four hours. Dec. 17, general condition much improved, the prostate has practically disappeared, the lateral lobes cannot be felt at all. Very little sediment in the urine. Dec. 19, residual urine, one-half ounce. Dec. 26, residual urine, one drachm. Dec. 28, urine normal. | April 19, the patient continued to be entire free from bladder symptoms. All h urine was passed naturally, he was healt and strong, mental condition unchange and resumed active employment. patient experienced "flashes," such occur in women during the menopaus May 25, patient considers himself cure |
| ad a stone in the bladder crushed in winter of 1893, but the vesical distress was but slightly relieved, which grew constantly worse. Urination was painful, and the least jar caused great pain. Urine contained albumen, pus, and mucus. | Two days. | Pain on passing urine perceptibly diminished. March 19, prostate about one-half size before operation and much softer. March 28, prostate smaller than normal. Before castration, passed fæcal matter of small calibre. One week after operation it had assumed the normal size. | This patient had a vesical calculus, whi added very much to his sufferings; enlargement of the prostate was so gre as to contra-indicate litholapaxy; o stone had already been crushed and moved by another operator, but wi rapid recurrence; double castration w performed especially to facilitate crushing and evacuating of the stone. March 28, the operation of litholapa was successfully performed. Conval cence was rapid. The patient left hospital April 4. His cystitis had disa peared, urination was entirely painle and he felt well in every particular. frequency of urination had diminishe but was still above the normal. patient experienced "flashes" like tho occurring in women at the menopause. |
| he patient was feeble, there was a general atheromatous condition of the vessels. Urine alkaline, and contained albumen, pus, and phosphates. | Forty-eight hours. | Passed about three ounces of urine voluntarily. On the next day, varying amounts of urine were passed at different times. The examination of the prostate showed appreciable lateral diminution in the gland. | Operation performed in less than six mi utes. Ten days later (time of this port), patient was passing about half his urine voluntarily and naturally, a said that if he were stronger, and cou stand up, he thought he could pass of it. The urine was clearing. |
| eneral condition good. Catheterism difficult and painful. | Four to six weeks. | Disappearance of blood and pus from urine. Reduction in length of urethra from nine and one-half to eight inches. | Nineteen weeks later, prostate normal size. One year later still using cathet but with ease and without pain. symptoms of cystitis have disappeare Dec. 4, began to pass a little urine (o half fluidounce) at a time for a few day |
| achectic, in low, nervous state from pain and constant desire to urinate. Could not pass more than No. 4 English bougie. | . . . . . . . . . . | No. 28 instrument passes easily now, there is no bladder trouble, urine normal. | Patient increased fifteen pounds in weig General condition excellent. Loo twenty years younger. Prompt disa pearance of all his symptoms. |
| ould pass only No. 3 English instrument. | . . . . . . . . . . | Prompt disappearance of all symptoms in three weeks. | Patient entirely free from any blad trouble No. 22 passes easily. |

## TABLE OF DEATHS.

| No. of Case. | Operator. | Age of patient. | Time of Death. | Improvement after Operation. | Cause of Death. | Remarks. |
|---|---|---|---|---|---|---|
| 36 | Glenn. | 82 | 8 days. | Urinated spontaneously four days after operation. | Uræmia. | “Nearly dead at time of operation.” No autopsy. |
| 104 | White. | 82 | 2 days. | Prostate thought to be a little smaller. Autopsy showed beginning atrophy. | “ | In profound uræmia at time of operation. |
| 49 | Hughes. | 75 | 17 days. | Seventh day patient passed urine without a catheter, a thing he had not done for years. | “ | Four days before death urine became albuminous. Proportion of albumen rapidly increased up to time of death. |
| 103 | Watson. | 70 | 9 days. | Decided relief of bladder pain and tenesmus. | “ | Delirious at time of operation; old double inguinal hernia operated on at same time; night after operation tore off the bandages; forced down the hernia. |
| 8 | Carver. | 74 | 18 days. | Passed urine spontaneously at end of a week, first time for weeks; during next week could empty bladder fairly well. | Uræmia and gangrene. | Pyelonephritis. Thrombosis of popliteal artery. Spreading gangrene. |
| 43 | Haynes. | Old. | Betw'n 2 and 3 months. | Sixteenth day. — Operator decides patient's life was prolonged by the castration. Passed one-third of his urine naturally; cystitis almost cured, prostate greatly diminished, later passes urine naturally; about two ounces residual urine. | Uræmia. | No autopsy. |
| 52 | Lichty. | 59 | 15 days. | Able to urinate with greater ease; residual urine one-half ounce instead of two and one-half ounces; prostate about half its former size. | “ | “Condition of kidneys was fully appreciated by both patient and operator; but the man insisted on operation because he preferred death to a continuance of his sufferings.” |
| 45 | Haynes. | 62 | 3 weeks. | Prostate thought to have diminished one-fourth in size, still about the size of a base-ball. | “ | Autopsy showed pyelonephritis, dilated ureters. |
| 50 | King. | 73 | 4 days. | At end of twelve hours patient had desire to urinate naturally and did not want catheter used any longer. Residual urine had decreased to less than two ounces, and the prostate was less than half its former size. | Pneumonia. | Autopsy showed distinct beginning of atrophy. |
| 48 | Moullin. | (?) | 11 days. | Ninth day blood-stained urine was passed spontaneously on several occasions. At the autopsy the prostate was found soft and flabby and appeared to have decreased in size. | Heart failure, Hæmaturia. | Kidneys cirrhotic; fatty heart; had had complete retention for fifteen months. |
| 13 | Faulds. | 66 | 26 days. | The urinary symptoms were mitigated a week before death. | Hemiplegia. | No autopsy. |
| 14 | “ | 71 | 10 days. | None. | Acute mania. | Probably uræmia. No autopsy. |
| 15 | “ | (?) | 12 days. | “ | Mania. | “ “ “ “ |
| 16 | “ | (?) | A few days. | “ | Acute mania. | “ “ “ “ |
| 39 | Halsted. | (?) | (?) | “ | Uræmia. | Autopsy showed double pyonephrosis. Prostate riddled with sinuses. Patient described as “desperate case.” |
| [illegible]8 | Finney. | 63 | 21 days. | “ | Uræmia; insane. | Patient had had attacks of insanity for years. |
| 40 | Halsted. | (?) | (?) | The patient voided urine naturally on third day and continued to do so until his death. The prostate diminished rapidly in size. | Nephritis. | Patient described as “desperate case;” no autopsy. |
| 47 | Horwitz. | 70 | 13 days. | Prostate had almost disappeared and the urgent desire to pass urine had almost disappeared also. | Uræmia. | “Patient's condition absolutely required operation of some kind.” |
| 86 | Stretton. | 60 | About 6 weeks. | The operation had materially reduced the size of the prostate and had restored the power of micturition. If it had been done earlier it would probably have prolonged his life. Passed urine spontaneously on tenth day; prostate reduced to one-half its former size. | Exhaustion. | |
| 82 | Souchon. | 63 | 6 weeks. | Improvement began on fourth day. Patient passed a stream of urine before his death. | Pneumonia. | Patient had had a suprapubic prostatectomy performed previously and had a permanent urinary fistula. |

# THE TREATMENT OF SPINA BIFIDA BY PLASTIC OPERATION.

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WHEN various operations are practised for the treatment of any diseased condition, it indicates, as a rule, that the affection is one difficult of cure or that no one method has greater merit than another. The object of the present paper is to attempt to show that the method of treatment by a plastic operation is worthy of more attention than it has hitherto received, and a list of the cases on which I have operated is furnished to enable those who are interested on the subject to form their own conclusions.

My views were first enunciated at the London Clinical Society in March, 1885, when I showed three patients who had been thus treated. In the discussion which followed, the treatment was favorably received. A committee, which was afterwards appointed to consider the whole subject of spina bifida, published a most valuable report on the anatomy and pathology of the deformity. The same committee also dealt with the treatment, and gave it as their opinion that the method of treatment by injection was probably the safest.

At that time it seemed to me that too great stress had been laid on the museum specimens and too little attention paid to actual clinical experience; but, in order to prove this, I felt that a greater number of cases was required; and what experience I have been able to collect in the mean time I now furnish.

My views have practically not changed since I read the paper referred to, but a larger experience has confirmed them.

I believe that, contrary to what is usually taught, a far greater number of cases of spina bifida coming under notice are instances of meningocele rather than of myelocele, and therefore more amenable to radical treatment, and that contrary to what is usually believed, even when nerves and cord are involved in the sac, an aseptic plastic operation can not only be safely performed, but will actually do less damage to those important structures than the injection of an irritant, which, if it does not lead to rapid death by shock or convulsions or to a general irritation of the nerve centres rapidly tending to hydrocephalus, is followed by a shrinking and atrophy of the sac and its contents whether nerves or spinal cord.

Within one year I operated on three cases of spina bifida by the injection of Morton's fluid, two of the cases were apparently cured, but hydrocephalus developed rapidly and within three months led to death, while in the third case, death occurred on the operating table, apparently from shock. That the latter is not uncommon I am quite sure, as I know of several instances where skilful surgeons have had the same experience.

A continued experience leads me to say that nearly all cases that call for interference may be treated by excision of the whole or part of the sac, or by some modification of this, with a great probability of success.

For practical purposes, it is convenient to divide all cases of spina bifida into three classes:

(1) Those where an operation is not necessary, as in cases where the sac is small and well covered by a firm pad of the integuments.

(2) Those where operation is not advisable, as in fissure of the whole or a considerable part of the spinal column, or where there is well-marked hydrocephalus or paraplegia.

(3) Those in which operation is indicated, as

(*a*) In meningocele, whether the opening in the spinal canal be large or small; in the one case meningeal, separate from integumental flaps, being formed; in the other, the pedicle of the meningocele being ligatured and the subcutaneous tissues and skin being brought together over this by separate sutures.

(*b*) In cases where the coverings are thin and translucent, even when this condition extends to the margin of the tumor, operation is advisable, as by rendering aseptic the thin covering, it may be partly utilized, if required, to form the meningeal flaps, when the adjoining skin can be undermined and made to slide over the new meninges.

(*c*) In cases where the cord is expanded or nerves are blended with the sac, excision of redundant parts or incisions between manifest portions of nervous structures, reduces the tumor and enables it to be placed in the canal, and usually there is no difficulty in covering the replaced structures.

It is of the utmost importance to render aseptic the parts as a preliminary to operation, and to observe the strictest antiseptic precautions at the time of operation and subsequently.

In most cases a silver or celluloid shield should be worn for a time after healing is completed in order to protect the cicatrix and to prevent it from bulging.

The following brief record of cases includes all that I have operated on, both in private and in hospital practice, and I know that many successful operations have been performed by other surgeons on the same lines. Among these I may mention :

The late Professor McGill, Leeds ; Mr. T. Pridgin Teale, Leeds ; Mr. T. R. Jessop, Leeds ; Mr. Edward Atkinson, Leeds ; Mr. Edward Ward, Leeds ; Mr. Norman Porritt, Huddersfield ; Dr. R. T. Hayes, Rochester, N. Y.; Dr. Sinclair ; Dr. Barton ; M. le Dr. Berger, Lariboisiere Hospital ; M. le Dr. Monod, France ; M. le Dr. Walther, France ; Dr. Kenenko, St. Petersburg.

The last-mentioned author remarks, " Of all other methods of treatment of spina bifida, puncture is most unreliable as well as dangerous ; while Mayo Robson's plan (complete extirpation with closing the defect with soft parts) is most rational."[1]

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[1] Transactions of the Third General Meeting of Russian Medical Men at St. Petersburg, Nos. 2, 8, 1889.

## TABLE OF CASES OF SPINA BIFIDA, TREATED BY PLASTIC OPERATION BY MAYO ROBSON.

| Date. No. | Name and Address. | Age. | Character of Tumor and Conditions of Coverings. | Operation. | Result. |
|---|---|---|---|---|---|
| 1<br>Oct., '82. | A. S.,<br>Leeds. | 6 days. | Lumbar meningocele, size of medium orange, sac excessively thin, inflamed at fundus and very tense. | Excision by meningeal and skin flaps, transplantation of periosteum. | Recovery. Well for nearly a year and then had teething convulsions. |
| 2<br>Dec., '82. | M. A.,<br>Leeds. | 18 days. | Lumbo-sacral meningocele, size of large orange, sac inflamed and sloughing quite to edge of tumor. Child suffering from general atrophy and hereditary syphilis. | Plastic operation, skin flaps obtained by undermining the adjoining skin, meningeal flaps formed from translucent coverings, opening into spinal canal 2¼ by ¾ inches. | Death from asthenia third day. |
| 3<br>Nov., '84. | E. J.,<br>Armley. | 16 years. | Lumbar meningocele, size of fœtal head, thin coverings, sac very tense and inflamed, talipes present. | After several aspirations plastic operation, skin flaps over ligatured base of meningocele. | Recovery. Patient living ten years after. |
| 4<br>Feb., '85. | D. C. | 7 weeks. | Lumbar meningocele, 7¼ inches circumference, 3½ inches across, coverings thin and ulcerated. Child thin and puny. | Meningeal and skin flaps, former united by continuous catgut suture, latter by interrupted silver sutures. | Recovery. |
| 5<br>Apr., '86. | C. M.,<br>Hull. | 10 weeks. | Simple meningocele in sacral region, size of walnut, thin translucent coverings inflamed. | Plastic operation. Ligatured meningeal base, covered by skin flaps. | Recovery. |
| 6<br>Aug., '86. | S. W.,<br>Eastbourne. | 12 weeks. | Cervical spina bifida. | Plastic operation, skin and meningeal flaps. | Death from shock or (?) from anæsthetic. |
| 7<br>June, '87. | S. H. L.,<br>New Wortley. | 11 days. | Syringo-meningo-myelocele, lumbar, 2½ inches vertically and same horizontally, translucent covering very thin, slight paralysis of right leg. | Skin dissected around tumor, membranes opened, nerves dissected from sides of sac, and returned into spinal canal, central canal of spinal cord exposed, skin flaps brought together by seventeen silver sutures. | Recovery. Made outpatient in three months. 1894 in good health, but paralysis no better. |
| 8<br>May, '89. | S. J. | 15 weeks. | Meningo-myelocele, size of small orange, lumbar, skin inflamed and ulcerated. | Plastic operation as in Case 9. | Death in thirty-six hours. |
| 9<br>Apr., '90. | C. D.,<br>Retford. | 1 year. | Meningo-myelocele, circumference 10 inches, elevation 3 inches, lumbo-sacral. Skin at base normal, at fundus thin, dark, semitranslucent and inflamed. | Skin dissected from tumor, meninges exposed and aspirated, sac opened, nerves separated from wall of sac and replaced, skin sutured over meninges. | Recovery. |

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| 10 | M. B.,<br>Pudsey. | 2 weeks. | Meningocele lumbo-sacral. Skin at apex inflamed. Size 4½ inches by 3 inches. Marasmus. | Skin reflected and base ligatured, wound healed by first intention; but the marasmus, from which the child was suffering, persisted. | Recovered from operation; but died from wasting ten days after. No convulsions. |
| 11<br>Dec., '91. | T. S.,<br>Leeds. | 4 years. | Meningocele lumbo-sacral, circumference 9 inches, skin translucent at fundus, but not inflamed. | Excision of meningocele, ligature of base by encircling catgut ligature, suture of skin flaps. | Recovery. Quite well, January, 1894. |
| 12 | R. S.,<br>Leeds. | 6 weeks. | Cervical meningocele, large, tense tumor filling up the back of the neck from the occipital to the interscapular region, acute inflammation of sac at time of operation. | Incision from middle of occipital regions to level of spine of scapula, meningeal and skin flaps. Healed by first intention. | Recovery. In perfect health six months after. |
| 13 | G. L.,<br>Leeds. | 9 weeks. | Lumbar meningocele, size of small orange, skin red and inflamed. | Plastic operation. | Recovery. |
| 14<br>Jan., '91. | M. J. | 3 weeks. | Cervical meningo-myelocele size of large orange, and very tense. | Plastic operation by dissecting off skin flaps, and then incising meninges, cord inside sac, meninges and skin sutured separately. | Recovery. |
| 15 | L. G.,<br>Leeds. | 11 weeks. | Lumbo-sacral meningocele, 6 inches circumference. | Plastic operation. | Recovery. |
| 16<br>Feb., '92. | A. H. | 35 years. | Meningocele, 18 inches in circumference, skin thick at base, thin and partly ruptured at fundus, which was ulcerated. | Skin flaps formed and meningeal sac opened, giving exit to four pints of clear fluid, base of sac ligatured, skin flaps united by interrupted sutures. | Recovery. Quite well when seen a year after. |
| 17<br>Nov., '92. | C.,<br>Douglas, I.O.M. | 12 months. | Meningo-myelocele, lumbar, fundus thin and translucent. | Skin flaps formed, sac opened, cord and nerves separated and returned into canal, meningeal pedicle ligatured, buried sutures applied to subcutaneous tissues over pedicle, skin sutured by silkworm gut. Healed by first intention. | Recovery. |
| 18<br>Mar. 15, 1893. | F.,<br>Shipley. | 4 months. | Meningocele in lumbar region, 3 inches circumference, thin translucent coverings. | Skin flaps, pedicle ligatured, deep sutures and, finally, skin sutures, cerebro-spinal fluid escaped third day through wound, apparently aseptic, convulsions tenth day and death at end of fortnight. | Death. |
| 19<br>Sep., '93. | C.,<br>Beeston. | 3 months. | Cervical meningocele, size of large walnut, thin translucent cover at fundus. | Skin dissected back, thin pedicle ligatured, deep sutures to subcutaneous tissues, interrupted skin sutures. | Recovery. |
| 20<br>Oct., '93. | M.,<br>Knaresboro'. | 4 months. | Meningo-myelocele, lumbar, size of orange, part of sac very thin and inflamed, the remainder firm and thick. | Excision of thin part of sac, meninges, sutured first and then sutured separately. | Recovery. |

# IMMEDIATE SUTURE OF THE GALL-DUCTS AND THE GALL-BLADDER AFTER EXTRACTION OF STONES, WITH CASES.

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THIS article is written in the belief that the operations of cholecystotomy and cholecystenterostomy have become too much the routine practice in the relief of gall-stones. The author holds that incision of the ducts or the gall-bladder followed by immediate suture is the proper operation in the majority of cases, and especially in recent cases.

Having formed this opinion a little more than a year ago, it is interesting to note that I have been able to do this operation in every case but one which has come under my care since that time. I have had five such operations: one on the hepatic duct, one on the common duct, and three on the gall-bladder. All have been successful.

CASE I.—*Removal of an Impacted Stone from the Hepatic Duct, with Immediate Closure of the Duct.* The patient, aged fifty-nine years, was a powerful man of good habits. He had been jaundiced thirty-five years before. His present illness began in March, 1894, when he became jaundiced and suffered severe pain in the umbilical region. He was confined to his bed for four months, suffering from attacks of intense pain which recurred every two or three weeks and lasted from two to three days. Each attack of pain was followed by a more intense yellow color of the skin, which cleared up between the attacks. He vomited frequently, and the stools remained clay-colored. He had steadily lost flesh for five months.

On August 27, 1894, he entered my wards at the Massachusetts

Hospital by the advice of his physician, Dr. Breck. On examination nothing could be felt in the region of the gall-bladder, except a vague sense of resistance. The urine contained a slight trace of albumen and hyaline, fine and coarse granular casts. While at the hospital he had one of these acute attacks in which his temperature rose to 104° F.

*Operation.*—On September 4 I opened the abdomen by an incision in the upper right linea semilunaris. The gall-bladder was found empty and flaccid, the ducts were palpated, and a stone was felt deep under the liver in the hepatic duct. The stone could not be pushed along the duct nor crushed with the fingers. No other stone was felt in the common or cystic duct. After separating numerous adhesions, the stone was seized between the thumb and forefinger of the left hand and pulled up from its deep position. Adhesions and duodenum were pushed aside until the stone appeared between the fingers with only the peritoneum and the wall of the duct covering it. The field of operation was packed with gauze to prevent contamination with bile, the duct was incised, and a stone the size of a robin's egg extracted. The duct was closed at once with catgut sutures, a second row of silk sutures including the peritoneum being placed outside. The duct was held with the fingers, and very little bile escaped. A drainage-tube and gauze was packed down to the sutured duct. A rapid and complete recovery followed. The duct did not leak, and on the second day the gauze drain was removed. On the fourth day the abdominal wound was completely closed by provisional sutures. The jaundice had partially disappeared, and the stools were natural in color. The patient was well in three weeks. Eight months after operation he was known to be in perfect health.

CASE II.—*Removal of an Impacted Stone from the Common Duct, with Suture of the Duct.*—This case has already been reported,[1] and will, therefore, not be given in detail. The patient had suffered from gall-stone colic, and cholangitis for ten years. She came to the hospital, with temperature 102° F. and pulse 110, in a state of extreme exhaustion and suffering. The gall-bladder was so large (size of child's head) that it was not recognized as such. I did an exploratory operation, and on finding the greatly distended and much thickened gall-bladder, I did a cholecystotomy for the relief of acute symptoms. The ducts were not explored on account of the patient's feeble condition. The acute symptoms were relieved, but the symptoms of cholangitis continued, and the stools continued clay-colored, all the bile escaping through the fistula. Four months after the first operation I reopened the abdomen and palpated the ducts until I found a large stone impacted in the common duct near the duodenum. I incised the duct and removed one large and several small stones and closed the duct with silk sutures. The patient made a good recovery, but when last seen the fistula of the gall-bladder was still open.

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[1] Boston Medical and Surgical Journal, July 26, 1894.

CASE III.—*Stones Removed from the Cystic Duct, with Immediate Suture of Gall-Bladder Incision.*—The patient, a woman of forty years, with chronic phthisis, awoke one night with severe abdominal pain and tenderness. She then discovered a bunch just above and to the right of the umbilicus. After two weeks illness' in bed the pain and tenderness passed off, but returned after vomiting on board ship. Since then the pain and tenderness had disappeared and returned at intervals. It had troubled her particularly while sitting at her work. (She is a seamstress.) The tumor had slowly increased in size. She had never been jaundiced, nor had the stools been clay-colored. She was pale, badly nourished, with a constant cough. To the right and slightly above the umbilicus there was a small rounded tumor, which was movable but attached to the liver, and was easily recognized as the gall-bladder. The urine contained slight trace of albumen with fine granular and hyaline casts with renal cells. On July 11, 1894, the abdomen was opened over the tumor, which proved to be the gall-bladder, about the size of an orange. On opening it two stones the size of a walnut were squeezed up from the cystic duct by external manipulation. The gall-bladder contained only mucus. The walls were much thickened (one-eighth of an inch) and intensely red, with gray, degenerate-looking patches on the mucous membrane. The ducts were palpated and sounded, but no more stones were found. The gall-bladder was closed by a continuous catgut suture in the muscular coat, and interrupted fine silk sutures in the peritoneal coat. The abdomen was closed with a small gauze drain leading to the wound in the gall-bladder.

The patient complained of colicky pain for a day or two, but made a prompt recovery, the wound healing by first intention.

The patient was seen eight months after the operation. The tuberculosis had advanced, and she was in very poor health. The liver was small, and the fæcal discharges had been gray in color for a time, but had become normal. There was no trouble in the gall-bladder region.

CASE IV.—*Immediate Suture of the Gall-Bladder after Extraction of Stones.*—The patient was a woman, aged thirty-seven years. Since childhood had had attacks of bilious colic. During the last six months had had attacks every three or four weeks, and in the last month five attacks. The pain was exceedingly severe, often causing the patient to faint. For the last two years she had taken chloroform for the pain. She was always tender in the gall-bladder region, and during an attack there was exquisite sensitiveness there. Fæces had only once been noticed as clay-colored. Jaundice was sometimes present during the attacks, but disappeared between times. The face had become dark and pigmented in the last three years. She had lost seventy-four pounds in weight, and had an expression of suffering. Nothing abnormal could be felt in the gall-bladder region. At the operation the gall-bladder was not thickened nor distended, but contained several large stones, and one was removed from the cystic duct, being pushed up with ease. The other ducts were clear. The gall-bladder was closed with two rows of stitches. A small gauze drain was left in the abdominal wound, which was removed on the fourth day. The wound healed by first intention, and the patient was discharged in less than a month.

The fifth case was an exploratory operation, in which the gall-bladder was opened and the ducts sounded and palpated, but no stone could be found.

The gall-bladder was closed by a double row of sutures and dropped without drainage. The wound healed quickly, but the patient still suffers from some obscure liver trouble.

*Stones in the Gall-Bladder or Cystic Duct.*—A few years ago, when the subject was new, Tait's success seemed wonderful, and cholecystotomy was considered satisfactory, but as our experience has accumulated we find that immediate suture of the gall-bladder is quite as safe in proper cases, and is much more satisfactory. Heussner, according to Voight,[1] has done this operation thirteen times with good results. Korte[2] reports five cases, all of which recovered. Successful cases are also reported by Abbe, Richardson, and many others. Bad results from a leakage of bile have rarely been reported in late years. In fact, there seems to be very little danger from this accident in cases where the common duct is clear and the walls of the gall-bladder are in a moderately healthy condition, and only such cases are suitable for immediate suture.

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[1] Deutsche medicinische Wochenschrift, 1894, No. 34.

[2] Sam. klinische Vorträge, 1892, No. 46.

Cholecystectomy was brought forward by Langenbuch as a radical cure for the formation of gall-stones, in that the stones were supposed to be formed in the gall-bladder. It has, however, been clearly shown that the nuclei of stones are formed in the liver. Cholecystectomy is, therefore, not a radical cure for stone-formation, and should only be practised in cases of malignant disease or of very severe inflammation of the gall-bladder or where the cystic duct is permanently closed.

Stones in the cystic duct have usually been removed by forceps through the gall-bladder, but there is always danger of pushing the stone into the common duct, which must be regarded as a serious accident. This happened to Kehr, and there are cases on record where the stone was pushed into the hepatic duct and never recovered (Bland Sutton, Richardson.) I have found that pushing the stones up by squeezing the duct with the hand is much more effective than fishing through the gall-bladder with forceps.

Incision of the duct is preferable to prolonged manipulation with hands or forceps.

Kehr[1] reports seven cases where he removed an impacted stone from the cystic duct by an incision of the duct, which was closed with sutures. In each of his cases he did a cholecystotomy for drainage of the duct, as well as to prevent back pressure of bile from straining the sutured duct.

*Stones in the Hepatic or Common Ducts.*—The problem here is to clear the ducts with as little damage as possible, so that they may resume their functions. When the stone is small and soft, it can sometimes be crushed between the thumb and forefinger or be pushed into the duodenum or back into the gall-bladder. Such a condition is most fortunate. Breaking up a stone with a needle or with padded forceps has been done with success in many cases by Tait, Thornton, Mayo Robson, and others, but it seems to me to be a method by which the duct might be seriously injured without the knowledge of the operator, whereas a linear incision followed by suture leaves the duct clear and sound. Nevertheless, needling or crushing a stone is the proper operation where the duct cannot be raised enough to place sutures.

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[1] Archiv für klinische Chirurgie, Vol. XLVIII, 1894, p. 619.

Cabot successfully incised the hepatic duct for an impacted stone. The opening in the duct was not sutured but drained. My own case, No. I, is the only instance known to me of incision and suture of the hepatic duct.

There are on record a number of cases in which stones have been cut out of the common duct. In several of these the duct has been drained (Richardson, Cabot, and others). In a few the opening has been simply tamponned with gauze (Hochenegg and Bland Sutton). Abbe and Gordon Lloyd partly closed the duct with sutures and drained it. McBurney successfully removed a calculus from the end of the common duct through an incision in the duodenum with subsequent suture. The results in these cases have been by no means discouraging. But immediate closure of the duct by sutures when possible is, of course, the most perfect surgical procedure in these cases. I propose, therefore, to give a *résumé* of the published cases, and to discuss the subject in detail. Terrier,[1] in an excellent article on choledochotomy, has already collected a number of cases, which I include:

(1) *Kummell* (*Deutsche medicinische Wochenschrift*, 1890, No. 12, p. 237).—Cholecystectomy having been finished for stones in the bladder, a stone was found in the common duct and at once removed by incision. Suture of dilated duct. Death in twenty hours from collapse.

(2) *Thornton* (*Lancet*, 1891, April 4) reports three cases. In the first he closed the common duct after the extraction of stones. Sutures not tight, hence a drain was placed down to the duct and another in Douglas's fossa. Recovery rapid. Was known to be well two years later.

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[1] Revue de Chirurgie, Nov. 10, 1892.

(3) *Thornton.*—Cholecystotomy for stones in the bladder followed by incision of the common duct, which was closed by sutures. Gall-bladder sutured to the abdominal wound; drainage. Recovery without a fistula. Up in nineteen days.

(4) *Thornton.*—Suture of common duct with a double row of sutures with drainage of space below the liver. The patient left the hospital in three weeks. Five months later well but slightly jaundiced.

(5) *Heussner* (*Deutsche medicinische Wochenschrift*, 1890, No. 34).—The gall-bladder was opened and five stones removed. This was closed with sutures. A stone was then found in the common duct near the duodenum. This was removed by incision of duct, which he sutured, but was unable to prevent bile from oozing between the stitches. Drainage. The patient recovered and left the hospital in three weeks.

(6) *Courvoisier* (*Chirurgie den Gallenwege*, Leipsic, 1889) had previously tried to crush the stone in the common duct and had abandoned the operation on account of the poor condition of the patient. At a second operation the stone was removed by incision. The duct was closed with sutures; gauze drain. Rapid recovery.

(7) *Courvoisier.*—Two operations, cholecystotomy first, later extraction of stone from the common duct followed by sutures which did not prevent leaking of bile, hence drainage. Bile flowed from the abdominal wound. Recovery.

(8) *Courvoisier.*—Cholecystotomy with removal of stones; the fistula remained open and the patient was not relieved.

At a second operation a large stone was removed from the common duct which was closed by sutures. Then a cholecystenterostomy was done and the bile fistula was closed. Recovery.

(9) *Küster* (*Verhandlungen der deutschen Gesellschaft für Chirurgie*, Twentieth Congress, April, 1891).—Two stones removed from the dilated common duct, which was closed by sutures (double row). Gauze drainage.

Eleven days after operation hæmorrhage from the drainage tract, which necessitated cauterization with thermo-cautery and tamponning with gauze. Recovery. A year later the patient passed two stones.

(10) *Rehn* (*Verhandlungen der deutschen Gesellschaft für Chirurgie*, April, 1891).—Cholecystectomy, followed by removal of five stones from the common duct, which was closed by sutures and the abdomen was closed without drainage. Recovery.

(11) *Braun* (*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1891).—Stone removed from the common duct, which was closed by sutures. Bile escaped into peritoneal cavity. Gauze drainage. Rapid recovery.

(12) *Rudolf Frank* (*Wiener klinische Wochenschrift*, 1891, p. 960).—After an unsuccessful attempt to crush or push a calculus into the duodenum it was extracted by incision of the duct, which was sutured. Drainage; recovery.

(13) *Küster* (*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1891).—The patient had an old bile fistula. A large stone was extracted from the common duct, which was closed with sutures; at the same time the fistulous opening in the gall-bladder was closed. Both wounds were tamponned with iodoform gauze.

Recovery was slow on account of long-continued suppuration of the fistulous tract.

(14) *F. Terrier* (*Revue de Chirurgie*, Paris, November 10, 1892).—Patient with cirrhosis of liver. Stones removed from the very end of the common duct in the head of the pancreas, opening in duct closed with sutures. Drainage; death on second day.

(15) *Marcy* (*Journal of American Medical Association*, December 20, 1890).—The distended gall-bladder was opened and a stone removed, but another in the common duct could not be dislodged. The duct was opened and the stone was then removed with difficulty; the opening in the bladder and the duct was sutured by three rows of stitches; the entire wound of the viscus measuring four inches. Abdomen closed without drainage. Rapid recovery.

(16) *Mixter* (*Boston Medical and Surgical Journal*, July 26, 1894).—Six stones were removed by cholecystotomy; the fistula remained open; three months later the common duct was incised and a large stone removed. The duct was sutured. Prompt recovery.

(17) *Murphy* (*New York Medical Record*, January 13, 1894).—Excision of stone from a one-inch incision in common duct, which was closed by a continuous suture. Death on the second day. No autopsy.

(18) *Ross* (*Canadian Practitioner*, April, 1894).—Several stones were lodged in the common duct. The duodenum was accidentally torn open; this opening was enlarged in the hope of reaching the stone through the end of the duct, but the opening of the duct could not be found. The common duct was then incised and the stones removed. The duct was sutured, but owing to its friability at the

part lately occupied by the roughened stone, it was impossible to prevent the leakage of bile. Iodoform packing and drainage. The bile continued to flow, but suddenly increased after vomiting, and the patient died fifty-six hours after the operation.

(19) *Mayo Robson* (*British Medical Journal*, April 28, 1894).—Case 52 in table. Large stone removed from common duct through an incision which was sutured. Drainage. Death from fæcal extravasation through a small hole in the colon, caused by separating adhesions and unrecognized at the time of operation.

(20) *Kehr* (*Archiv für klinische Chirurgie*, Vol. XLVIII, p. 619, 1894).—Cholecystotomy for empyema of gall-bladder. Several months later a stone could be felt with a sound in the cystic duct. In attempting to extract this with forceps the stone was pushed into the common duct. Ten months after the first operation the stone was removed by choledochotomy. The fistula healed in three weeks.

Including my own cases there are twenty-two cases with five deaths, and including Kehr's cases of suture of the cystic duct there are twenty-eight cases, making a mortality of less than 18 per cent. In considering this mortality, we must remember that the cases include the most unfavorable forms of cholelithiasis, and that the stones were removed from various parts of the ducts, and some of them under the most unfavorable conditions as regards peritoneal adhesions and secondary disease of the liver, also that they were done by fifteen different operators.

Of the five deaths one was due to shock, one to cirrhosis of the liver, one to an accidental injury of the intestine, and only one to leakage of bile.

In five of the cases, bile leaked through the stitches, but only one of these died. Drainage, usually gauze, was used in every case except three. Küster, Rehn, and Marcy closed the abdomen without drainage with recoveries, but Küster had leakage of bile from the abdominal wound. In seven cases the gall-bladder was left open, six times by a cholecystotomy and once by a cholecystenterostomy; all recovered. Heussner, Courvoisier, and Marcy having opened the gall-bladder as well as the duct, closed both at the same operation with good results. Küster closed a fistula and Kummell did a cholecystectomy, at the same time suturing the common duct. Courvoisier having sutured the duct, closed an old fistula and then did a cholecystenterostomy at one sitting, which seems a most unnecessary complication of operations, as the fistula would probably have closed after the stone was removed from the common duct.

Convalescence was short in the majority of these cases; four left the hospital in about three weeks, others are reported as recovering "rapidly."

As before stated, it is essential in every case that an outlet should be provided for the bile. If, therefore, the gall-bladder is to be sutured we must make sure that the common duct is open. If the hepatic, cystic, or common ducts are to be sutured, we must make sure that the ducts are clear below the point of suture; if they cannot be cleared, we must provide an outlet for the bile in the other direction, either by a cholecystotomy or by a cholecystenterostomy.

In certain cases the condition of the patient will not admit of a complete operation at one sitting; in such cases cholecystotomy may be done for the relief of cholæmia, and the stones may be removed from the common duct by a later operation.

It is in this class of cases that cholecystenterostomy has, it seems to me, been done altogether too frequently of late. The very important invention of Murphy's button has so greatly reduced the mortality of this operation that the main object—that of restoring the ducts to their normal condition—seems often to have been lost sight of in the zeal for an immediate success. Murphy reports seventeen cases done by himself and others without a death; but less favorable reports have followed. In many of these cases no attempt was made to remove the stones from the gall-bladder, and the ducts were not even examined, yet these cases are reported as well. In my opinion no case is well as long as stones remain in the duct. Stones in the duct, even when the bile pressure is removed, continue to cause cholangitis and chronic peritonitis much as a diseased appendix or Fallopian tube does. They are foci of inflammation, and cause processes of ulceration. To be sure, some of the stones loosen and come out, but, on the other hand, they are often impacted and held by a cicatricial stricture (Abbe). If the stones loosen and come away, leaving the ducts clear, it is much better that the patient should not be left with the gall-bladder opening into the intestines. That there is a real danger of the bacteria of the intestine penetrating the biliary fistula and infecting the liver is shown by a case reported by Ricard[1] in which death occurred fifty-three days after the operation of cholecystenterostomy, although the patient did well at first. Death was found due to infection of the bile passages from the intestinal canal, numerous abscesses of an ascending infection being present.

I think, therefore, that cholecystenterostomy should be limited to cases in which there is an irremediable stenosis of the common duct.

The question of doing a cholecystotomy in connection with the suture of the ducts is one of great importance. Kehr thinks it should always be done, as a duct which has been obstructed ought always to be drained for a time. On the other hand, we have seen that many cases have done admirably without opening and draining the gall-bladder. It seems to me certain, however, that in all the cases where the duct has been incised and cannot be sewed or is imperfectly sewed, or where the stitches cut out on account of the friable condition of the duct, a cholecystotomy ought to be done to prevent the distention of the duct. Cholecystotomy ought always to be done where the pathological condition of the bile-passages requires drainage, as in empyema of the gall-bladder and suppurating cholangitis. Nevertheless, I believe that the ordinary conditions due to obstruction recover without drainage soon after the obstruction is removed, as may be seen from the cases reported in this paper.

*Technique.*—The objection to immediate suture of the ducts is the difficulty of the operation and its supposed dangers. Thornton speaks of the great difficulties of sewing the common duct, and used a Ferguson speculum to expose the duct in its deep position. Cabot used a hooked knife to incise the duct by touch. As I have found the operation less difficult than I expected, I will give the method by which I sutured the hepatic and common duct. The patient is hung by straps under the arms on an inclined plane at an angle of something less than forty-five degrees. A sand-bag is placed under the back, so that the patient is bent over it. In this position the intestines gravitate to the lower part of the abdomen, so that when the liver is held up by a retractor the air sucks in between the liver and intestines much as it enters the pelvis in the Trendelenburg position. The abdomen is opened in the right linea semilunaris. The gall-bladder is seized and pulled up, and the course of the ducts is palpated with great care. When a stone is found, the rest of the ducts should be palpated with especial care, as the success of the suture depends on the unobstructed flow of the bile. When a stone is found, it is grasped with the thumb and finger of the left hand and raised to as convenient a level as possible. The fingers should not be removed from the duct

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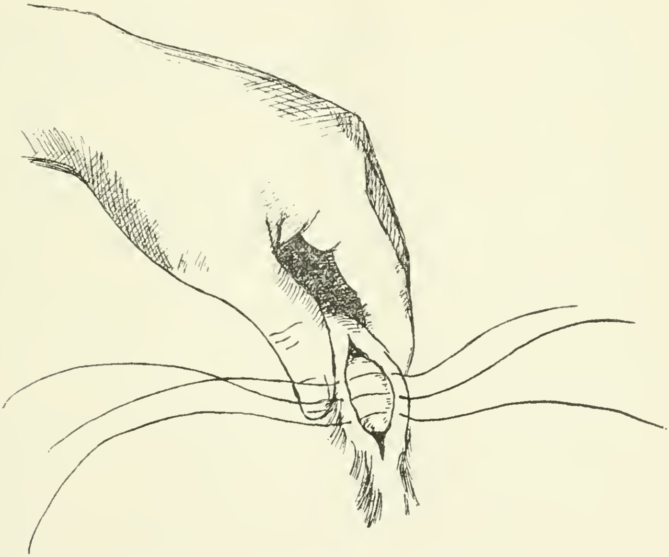
[1] Bul. Soc. Chirurgie, XX, p. 572, 1894.



The duct is held by thumb and finger of left hand. The stitches are placed before the stone is removed.

until the stitches are tied. The duct is incised over the stone by a longitudinal cut. The stitches are then placed in the sides of the duct before the stone is removed (see Fig.); for the instant the stone is removed the duct collapses and the wound is bathed in bile and cannot be brought into an accessible position again. As the stone is removed the fingers may squeeze the duct above to prevent the flow of bile before the stitches are tightened; at this point a sound can easily be passed down the duct if desired. Two rows of stitches are placed, catgut being used for the duct itself and silk for the overlying peritoneum. A small drainage-tube is passed down to the duct and surrounded with gauze. The abdominal wound is closed except at the point where the gauze is to be removed.

## Conclusions.

(1) Every operation should be conducted with the idea of restoring the functions of the ducts, and that any irreparable injury to them is a serious calamity.

(2) Immediate closure of the gall-bladder is safe if the ducts are clear and its walls healthy.

(3) Incision and suture of the cystic duct is preferable to prolonged manipulation.

(4) Incision and suture of the hepatic and common ducts is the operation of choice for impacted stones.

(5) The mortality of this operation is less than 18 per cent.

(6) If the condition of the patient is critical, a preliminary cholecystotomy is advisable.

(7) Cholecystenterostomy should be reserved for irremediable stenosis of the common duct.

# THE RADICAL CURE OF VARICOCELE.[1]

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OF NEW YORK,

SURGEON TO THE NEW YORK HOSPITAL AND TO ST. LUKE'S HOSPITAL.

I HAVE ventured to bring forward for consideration an old and comparatively unimportant subject. My principal reason for its introduction is to ascertain, if possible, from the members of this society their experience in the operative treatment of varicocele as well as their opinion as to the best method of effecting a radical cure. It is not my intention to discuss the many methods of treatment which have been proposed in the past, but rather to confine myself to a brief consideration of the operations which, as far as my observations go, are practised by the surgeons in this vicinity. For the sake of convenience I shall speak of three methods: first, the subcutaneous; second, the open; and, third, the method of ablation. Of the operations belonging to the first method, that of subcutaneous ligation of the spermatic veins with sterilized silk or catgut ligatures has given the best results. It is simple, easy of performance, and under proper antiseptic precautions very safe, and in addition necessitates but a short period of confinement. As the operation is so well known, I feel that it is unnecessary to describe the manner in which it is performed. With all the advantages which have been claimed for it, its application, however, may be said to be limited to the cases of small varicocele, which require only a single ligature. For large or even moderate-sized varicoceles, where two or more ligatures are required, this operation is open to objection, and is not unattended with danger. It is uncertain as regards radical cure, as we can never be sure that all of the affected veins are included in the ligature, a condition which is absolutely essential to prevent recurrence of the disease. Another objection is the liability of placing the ligature too close to the testicle, a proceeding which may be followed by pain and induration of the gland, thereby interfering with a rapid and painless convalescence. Then, again, there is the danger of puncturing with the needle one of the enlarged veins, an event which may not be of great importance, but one which has been attended with unfortunate results. Before the days of antiseptic surgery the subcutaneous method was the one universally employed, as the open method was almost always followed by suppuration and frequently by fatal septic phlebitis. Since the introduction of the antiseptic wound treatment the open operation has been revived, and with such favorable results as to give it the preference with many surgeons. As ordinarily performed, the affected veins are exposed through a scrotal incision, a double ligature of silk or gut is placed around them, and the portion of the varicocele included between the ligatures is excised. The wound is closed with or without drainage, as the operator may prefer, and an antiseptic dressing applied.

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[1] Read before the New York Surgical Society, April 10, 1895.

The operation has been modified by W. H. Bennett,[1] who not only excises the dilated veins, but at the same time effects an immediate and permanent shortening of the cord. Before the operation, with the patient in the standing position, he estimates by the eye, or better by a tape measure, the degree of elongation of the cord, and thus decides on the amount of the varicocele to be resected. Through an incision, which need not exceed one and a half inches in length, he exposes the fascia which immediately surrounds the varicocele, but does not actually denude the veins. A catgut ligature is passed around the fascia with its included veins, and drawn down to a point as near the testicle as is thought proper and then securely tied, the ends being left long. The varicocele above the ligature is then freed, together with its sheath, by the finger from the surrounding tissues for a distance long enough to allow the portion to be excised to be drawn out of the wound. A second ligature is then passed around the upper end of the exposed veins and tied, the ends of the ligature also being left long. The portion of the varicocele included between the ligatures is divided above and below, at a distance not less than a quarter of an inch from the corresponding ligature, and is then removed. The cut ends of the stumps are then approximated and kept in permanent apposition by knotting together the ends of the upper and lower ligature, thus bringing the testicle up to its proper level. The ligature ends are cut off quite short.

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[1] Lancet, February 9, 1889.

By leaving the fascia which immediately surrounds the varicocele intact two objects are attained,—

(1) The certainty of passing the ligature around all of the affected vessels, as none of these ever lie outside of the fascia; and,—

(2) The prevention of any material chance of recurrence of the abnormally dependent position of the testicle, which is probable if the veins are actually denuded before the ligatures are applied and the stumps brought together in the manner described below, since it is manifest that the weight of the testis would tend to drag the veins considerably out from the sheath above, whereas the fascia, if included in the ligatures, not only obviates this tendency, but, in fact, also carries the weight of the dependent organ without stretching it to any considerable extent.

Little or no pain follows the operation; the patient is confined to bed about a week, and is able to resume work in a fortnight, wearing a suspensory bandage, which can be left off in a month.

The open method is preferable to the subcutaneous in that it is as simple in execution, is more certain in its results, and when performed under antiseptic precautions is attended with no more risk.

Ablation of the scrotum, a method which has been extensively practised in this city, has been followed so frequently by recurrence that many surgeons have abandoned it. Frequent recurrence is a natural sequence, as the operation does not remove the cause of the trouble, and, owing to its elasticity, the scrotum rapidly stretches and resumes its former length. Combined with subcutaneous ligation or open excision of the veins, it has given good results, but the success should be credited rather to the occlusion of the veins than to the shortening of the scrotum.

My experience in the operative treatment of varicocele is limited to nineteen cases, the majority of which were in hospital practice. In two cases subcutaneous ligation was performed, once with sterilized gut and once with sterilized silk. The varicoceles were of moderate size, and in neither case was there elongation of the scrotum. Both did well, and were discharged in seven and eleven days respectively.

In the case where catgut was used there was recurrence in a few months; in the other, the result was satisfactory two years after operation.

Subcutaneous ligation with catgut combined with ablation of the scrotum was performed in one case, and the patient was discharged from the hospital in eighteen days. Four months afterwards recurrence took place and excision of the veins was refused.

In three cases ablation of the scrotum with the aid of Henry's clamp was resorted to. The varicoceles were rather large, and in one case the veins on both sides were affected. The wounds healed *per primam*, and the average duration of confinement was eighteen days. In two of these cases there was recurrence, the other one was never seen after his discharge from hospital.

In eight cases open excision of the veins combined with ablation of the scrotum was practised. Five were of large size, the other three of moderate size, and in all the scrotum was elongated.

In six the wound healed promptly, and beyond some œdema of the scrotum and slight tenderness of the testicle nothing was noted. The average duration of confinement was eighteen days. In one case convalescence was delayed by a secondary hæmorrhage from a scrotal vein, necessitating the reopening of the ablation wound, turning out some clots and ligation of the bleeding vessel. In one case there was suppuration, and the formation of a small abscess at the site of one of the ligatures. This was a case of large varicocele, and the veins were tied off in several packets, thus requiring the use of several ligatures. Suppuration appeared on the eighth day after operation, whereupon the excision wound was reopened and a small amount of pus containing a sloughing catgut ligature was evacuated. It may be of interest to note in this case that for three days preceding the evacuation of the abscess the patient suffered from paroxysmal hæmoglobinuria. Repeated urinary examinations revealed no lesion of the kidney, and a cystoscopic examination of the bladder was negative. With the evacuation of the pus the urine resumed its normal color, and remained so as long as the patient was in the hospital. Of these eight cases, five were seen some months after operation and there was no recurrence; the other three were not heard from.

In five cases excision of the veins according to Bennett's method was carried out. Four were of moderate size, one a very large one, and in all the scrotum was elongated. All healed by primary union and were thoroughly satisfactory, and the average duration of confinement to hospital was fourteen days. Four have been seen at periods varying from six months to two years after operation, and the results are very satisfactory. In all the four cases the shortening of the cord was maintained, the scrotum fitted closely about the testicle, and at the site of the ligatures slight induration remained.

As a result of my limited experience, I will merely state that my preference is for the open method, which is best illustrated by Bennett's operation, as the one most likely to effect radical cure of varicocele.

# THE TREATMENT OF TUBERCULAR ABSCESS.[1]

BY WILLIAM J. TAYLOR, M.D.,

OF PHILADELPHIA,

PROFESSOR OF ORTHOPÆDIC SURGERY IN THE PHILADELPHIA POLYCLINIC; ATTENDING SURGEON TO ST. AGNES'S HOSPITAL; ASSISTANT SURGEON TO THE ORTHOPÆDIC HOSPITAL AND INFIRMARY FOR NERVOUS DISEASES.

THE best method of treating tubercular abscess, especially abscess following in the course of hip-joint disease, is a subject of great importance and well merits a free and full discussion.

There are three plans commonly employed, each differing essentially in detail and theory, and each strongly advocated by men of experience and wide reputation.

In attempting to discuss a question about which such widely-diverging views are held, it is necessary that we give due prominence to and respect for the opinions of these men.

The first plan commonly employed is that of doing nothing at all surgically, but to sit calmly by and allow the abscess to do as it likes, and, after burrowing extensively under the tissues, to burst and discharge its contents at nature's own point of selection. Those who advocate this expectant plan of treatment claim that the place of spontaneous discharge is the most favorable point for drainage for that particular abscess, that the wound is smaller and the prospect of rapid closure better.

They contend that a tubercular abscess is really not an abscess in the true acceptation of the term, for the germs of suppuration are not present; that by opening the cavity with a knife we run the risk of carrying infective material into it, thus setting up a second and suppurative process with all its attendant dangers; and, further, that the probabilities of infection during the dressings are very great. We must admit also that tubercular abscess, if small, will occasionally become absorbed and disappear, or, at least, become quiescent. There is, however, the ever present danger of their contents becoming irritated and a lighting up of the old trouble resulting, not to speak of the possibility of general systemic tubercular infection.

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[1] Read before the Section on General Surgery of the College of Physicians of Philadelphia.

The second plan is that advocated by those who believe nothing should be done till the abscess is large and its walls thin. At this stage the cavity is to be aspirated, all of its contents, as far as possible, removed, the cavity washed out through the aspirator with some form of mild antiseptic fluid, and then injected with a solution of iodoform in oil or glycerin. This latter is used for the purpose of bringing the iodoform in contact with the whole inner surface of the abscess wall and in the hope of destroying the tubercle bacilli in the lining granulation tissue. As yet we have no agent which destroys these germs so well as iodoform.

We are often able to gain the consent of patients and of their parents to do this, when more active surgical interference will not be permitted. It must be borne in mind that this procedure is not without grave danger to the life of the patient, for we inject large quantities of iodoform into a closed cavity, and I have several times seen violent poisoning occur.

My own experience of this method of treatment has not been encouraging, as I cannot recollect a single case where its use was perfectly satisfactory. I admit, however, that others have been successful and strongly advocate this method. They contend that if the first injection is not successful it should be repeated once, twice, or three times if need be at various intervals of time, and that at each injection the size of the cavity is lessened and the amount of iodoform necessary to be used smaller.

I do not believe it possible, however, to remove through the small needle of an aspirator the cheesy masses and broken-down tissue which we always find present in these cases, and I have found it necessary in a short time to open such abscesses by a free incision and clean them out.

The third plan, and that which I have found to the best, is to treat the abscess on true surgical principles, just as we would a collection of pus in any other form, but, with the understanding that we are dealing with a condition where there are no germs of putrefaction.

This is by free incision, thorough curetting of the walls of the abscess cavity while the wound is being flushed with plain boiled sterile water, and then complete closure of the wound in the skin without drainage.

This plan I have found most useful in all forms of tubercular abscess.

The surface of the abscess is rendered aseptic for twelve or twenty-four hours before the time set for the operation by the following method: (1) The skin is washed well with green soap by means of a nail-brush; (2) ether is then used to remove all oil from the skin; (3) a solution of bichloride of mercury is then used of the strength of 1 to 2000, and a sterile dressing wet with the same solution is then applied and allowed to remain in contact with the skin until the patient is under the influence of the anæsthetic at the time of the operation.

An incision is then made into the abscess, which should be long enough to permit of the exploration of its cavity by the finger of the operator, the length of the incision, provided it be free, being of small moment. Next, the wall of the abscess cavity is to be thoroughly curetted with a Volkmann's spoon if the tissues are dense, and then, with what I find most efficient, a mass of sterile gauze held in a pair of forceps.

This gauze curette is not new, but is not used as often as it should be, for it can be used in cleaning out the cavity of a pelvic abscess as well as the more superficial ones and the danger of injuring the peritoneum is slight. Of course, in all curetting the amount of force to be used must depend upon the character of the tissues involved and of the proximity of important structures. In this way all of the granulation tissue containing the tubercle bacilli is scraped away and little or no violence is done to the sound structures, while a large mass of material is removed which can be gotten rid of in no other way.

Gauze used in this way to swab out the wound is efficient; it is safe, for unless very exceptional force is used it can do no harm to blood-vessels and other delicate structure, and where a metal curette would do much damage. During all the time the swab is being used a stream of plain boiled water is flowing into the wound and washing out the broken granulations and shreds of tissue. This stream of water constantly flowing I consider of the greatest importance, as it enables us to get rid of much tubercular matter that would otherwise escape our notice and remain in the wound.

After the cavity is thoroughly cleaned out and the return flow of the water is clear, the wound should be mopped dry with sterile gauze sponges and closed with silkworm-gut sutures.

No drainage whatever should be used, and in a great many cases we can get primary union of the wound. Halsted's subcuticular suture of silver wire or silkworm gut answers admirably, and prevents the possibility of infection from the skin.

At times there will be a small accumulation of wound discharge which will burst through the line of incision at some one point, but as soon as this fluid is liberated the healing process goes on without interruption.

The tendency in all tubercular wounds is to the formation of sinuses, and I consider the use of a drainage-tube in these cases objectionable as tending to their formation.

If, however, the abscess be very large, this is especially applicable to abscesses of the trunk and much less so to the hip, where it has been found impossible to reach every part of the cavity with the gauze curette, a drainage-tube may be used to get rid of the wound discharge for the first twenty-four hours, but under no circumstances where rapid union is expected should the tube be allowed to remain in position for a much longer period of time.

If primary union be not secured, this method of treatment enables us to thoroughly clean out the abscess cavity, to rid it of the broken-down tissue and the products of tubercular inflammatory processes and with the certainty of the removal of a large number of tubercle bacilli. If these bacilli are allowed to remain in the tissues, they may very readily become the source of a general systemic infection.

At the same time we lessen the size of the abscess cavity, diminish the amount of wound discharge, and enable healing to take place much more rapidly.

Certainly this is the most satisfactory method of treating these cases which I have yet undertaken, and gives most gratifying results in the vast majority of cases, while, at the same time, the comfort of the patient is much increased.

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, March 4, 1895.*

The President, THOMAS G. MORTON, M.D., in the Chair.

## A JACK-STONE IN THE ŒSOPHAGUS NECESSITATING TRACHEOTOMY TO RELIEVE DYSPNŒA.

DR. WILLIAM J. TAYLOR related the history of a little colored boy, aged three years, who was admitted to St. Agnes's Hospital on April 3, 1894, with the history that he was playing with some iron jack-stones, when he suddenly began to cough and to struggle for breath. When first seen by the reporter, about two hours after the accident, there was such extreme respiratory distress that prompt relief was necessary. A careful search was made of the mouth and fauces with the finger, but without revealing the presence of a foreign body, and, as the dyspnœa was too great to permit of a prolonged examination, he opened the trachea without giving an anæsthetic. As soon as this was done the relief was instantaneous. Nothing could be found in the trachea or bronchial tubes, and a silk catheter could be passed into the mouth from below.

A catheter was passed down the œsophagus nearly to the stomach, and also a pair of long-curved forceps, but without meeting with any obstruction or evidence of a foreign body.

A small silver tube was introduced into the wound in the trachea, and the child put to bed in a room specially prepared for him.

At first the child was able to swallow fluids in small quantities with comparative ease. Then another and even more careful search of the gullet was made. Upon pushing the finger far down the throat he was just able to feel a smooth hard body, which proved to be the rounded point of an iron jack-stone. By external palpation of the neck nothing could be felt that would lead to the supposition that a foreign body was present. After some little difficulty the jack-stone was grasped in the jaws of a pair of curved forceps and removed. The care necessary to do this, on account of the large size and irregular shape of the jack, made it a tedious process. The utmost gentleness was exercised in these manipulations, but the mucous membrane was somewhat torn, for quite an amount of bloody mucus was brought up.

The child died on the fifth day from exhaustion. No post-mortem examination was permitted.

At the time of his first examination, just prior to the tracheotomy, he could not feel the jack with his finger passed well down the gullet, neither could he feel any obstruction to the passage of the forceps nor to the catheter, which he thought had passed into the stomach. Both must have passed below the point at which the jack was subsequently found.

The interference to the respiration was due entirely to the jack-stone within the œsophagus which pressed upon the trachea without the trachea itself.

Dr. Taylor said that this case had been a severe lesson to him, and had taught him that in all cases of dyspnœa, supposed to be due to a foreign body within the trachea, a careful search of the gullet should first be made, and the probang should be passed into the stomach itself. Until this is done we must not open the trachea, providing this can be done without jeopardizing the life of the patient by too long and exhausting a search.

Dr. John B. Deaver said that he had recently operated upon a lady who had swallowed a fish-bone, which lodged temporarily in the œsophagus, but which, however, could not be found. Upon the day following the accident he found not only emphysema of the neck but also some fluid deep in the tissue of the neck. The effusion did not connect with the trachea. He cut down upon the swelling, evacuating a small amount of very fœtid pus. At the bottom of the wound, located behind the lateral lobe of the thyroid gland, was seen some slough and an opening which communicated with the œsophagus. The bone was not found. The wound was packed lightly with iodoform gauze. Owing to the age of the patient, the difficulty in feeding her, and the extensive sloughing, death occurred within a week following the opening made in the neck.

Dr. J. M. Barton said that some years ago he saw in Camden a child who had a jack-stone in its throat similar to the case reported. The size of the jack-stone precluded the idea of its being in the larynx, although there was impairment of voice. The foreign body was discovered pressing against the back part of the œsophagus, where it caused ulceration, from which the child ultimately perished.

Dr. Deaver remarked that he had seen ulceration of the larynx result from the pressure of a foreign body in the œsophagus.

Some years ago he performed œsophagotomy for the removal of a partial plate of artificial teeth which had occupied the œsophagus for seven days. Death resulted from sepsis. Post-mortem showed ulcerative communication between the œsophagus and the larynx.

Dr. R. H. Harte said that at St. Mary's Hospital he saw a man who, in a fit of depression, had wounded his throat and œsophagus with a razor, and in addition had plunged a red-hot iron into his right side and penetrated the liver. When he attempted to swallow liquids they regurgitated through the wound in the neck. The physicians present suggested œsophagotomy, and he recommended the passing of a tube down the œsophagus into the stomach, through which he could be fed. This was done, and the patient recovered.

Dr. Wm. W. Keen recalled a number of cases of asserted swallowing of foreign bodies, especially fish-bones. The great difficulty in these cases is in determining whether the foreign body is really there. In the cases reported very careful examination failed to detect the presence of the jack-stone. He asked if any attempt was made to relieve the patient by feeding him with potatoes to facilitate the passage of the jack-stone. A few days before he saw a physician who, in swallowing a piece of toast, coughed a piece of the crust into his naso-pharynx. Acute pharyngitis followed, which extended up the tubes and caused mastoid disease. An abscess formed, which burrowed to the pharyngeal wall. He operated upon him and chiselled away most of the mastoid. This was mentioned to show how much injury might be done by such a simple body. The man was in good health at the time it occurred.

Dr. Taylor rejoined, as to feeding the child upon potatoes, that the difficulty was that when he saw the child the respiratory distress was so great that tracheotomy had been done at once. Moreover, he had very little idea that there was a foreign body in the œsophagus at all, as he attributed the difficulty in swallowing to the pressure of the tracheotomy tube.

## MALGAIGNE'S HOOKS FOR FRACTURED PATELLA.

Dr. John B. Deaver presented two cases of fracture of the patella to show the result obtained by the use of Malgaigne's hooks. The hooks were introduced the same day in each case, one week following the fracture. The hooks were introduced under aseptic precautions and with the patient anæsthetized. It is now six weeks since the introduction of the hooks, and the result in each case is most satisfactory.

The degree of flexion and extension is almost normal. The apposition of the fragments is perfect. No claim for bony union is made, as he believed that this can be obtained only by opening the joint and wiring. The Barker operation, that of subcutaneous ligation, offers no advantage over the use of Malgaigne's hooks, the result obtained in both instances being practically the same, the risk being increased by the ligature method.

Dr. R. H. Harte thought that Dr. Deaver's testimony with regard to Malgaigne's hooks agreed with the testimony of most experienced surgeons. They have been objected to by persons who have never tried them. Their results are much more satisfactory than those from the starch bandage recommended by Agnew.

Dr. J. M. Barton would like very much to see a series of fractures of the patella about one or two years after the injury. It is very common immediately after any method of treatment to see close approximation, but in time they usually stretch some inches apart. It would be of great importance to determine if exposure of the patella by incision, removal of the interposed torn edges of the capsule, and wiring of the patella will not give better results than the use of Malgaigne's hooks. It is certainly quite unfair to the patient to expose him to the risks of the graver operation if the milder will give equally good results.

But the exhibition of patients immediately after getting out of bed proves nothing. If the fractured ends of the patella are equally close one or two years later, the efficiency of the treatment will be fully proved.

Dr. J. Ewing Mears thought that the fracture of the patella is not the injury we are called upon to treat; but a rupture of a ligament,—the patella being only a sesamoid bone developed in the tendon of the quadriceps muscle, and fractures of this bone are incidental to ruptures of this ligament. When this is the result of force applied directly, there is little or no separation of the fragments. But in the cases caused by muscular contraction the ligament is much torn and the fragments are widely separated. This difference in the degree of separation of the fragments under the two causes, to his mind, proved conclusively that the ruptured ligament is the lesion present demanding treatment, and not the fractured sesamoid bones.

Whatever the plan of treatment adopted, it should have for its object the union of the ruptured fibres in the ligament as firmly as possible. He had kept patients in bed for three months in order to make these adhesions very firm. If the fibres of the ligament are greatly lacerated and stretched, it will be necessary to cut down and remove the portions of the torn ligament and approximate the ends by suture. In cases of direct force the ligament is not torn, separation of the fragments of the bone does not occur to any extent, and treatment is very much shortened.

## NEUROMA OF THE BRACHIAL PLEXUS.

Dr. John B. Deaver presented a man, aged forty years, who was operated upon by him for tumor of the neck, January 17, 1895.

Careful dissection, exposing all the tissues of the neck in relation with the three cervical cords of the brachial plexus, demonstrated the presence of an oblong tumor, smooth in contour, involving the upper of the three cords. The growth was so intimately associated with the nerve-trunk in question that it was necessary to divide the cord on either side to effect its removal. Strange to say, paralysis did not follow the division of the cord; there was but slight motor disturbance.

Doubt having been expressed that the cord that had been severed was really what it was supposed to be, he said that there was no doubt that the tumor, which when examined proved to be a neuroma, was so intimately connected with the upper cervical cord that to remove it required section of the cord above and below the growth.

An attempt was made to splice the divided ends of the nerve, but it could not be done. They were connected, however, with several strands of catgut.

The apparently puzzling part of this case is the absence of paralysis following removal of the tumor.

When we consider that this growth first showed itself seven years ago, and that it has been as large as at the time of its removal for some months, and that it involved the entire upper cervical cord of the plexus, as proven by examination of the specimen, he asked whether paralysis would be expected to follow the removal of that which had already destroyed the conducting power of the affected cord?

## CONTRACTED BLADDER.

Dr. Deaver presented a case illustrating a very marked form of congenitally contracted bladder. The trouble, that of frequent micturition, dated back to three years of age. The capacity of bladder when he came under his notice was about one and one-half ounces. Examination of the urethra with urethroscope and of bladder with cystoscope was negative other than demonstrating the small size of the bladder. Perineal cystotomy gave relief while drainage-tube was *in situ* and for two months after the wound had healed. He now returns six months since the operation with the symptoms quite as bad as when he saw him for the first time.

## EXCISION OF THE ELBOW-JOINT FOR ANKYLOSIS FOLLOWING FRACTURE.

Dr. H. R. Wharton presented a woman, aged thirty-five years, who received a fall April 29, 1894, sustaining an injury of the right elbow. In October, 1894, he found marked deformity in the region of the internal condyle of the humerus and a posterior dislocation of both bones of the forearm, the arm being rigidly fixed at a right angle, and the patient complained of constant pain in the elbow.

On November 8, 1894, he excised the right elbow-joint, finding that there had been a fracture involving the internal condyle of the humerus, and that the ulna and radius were dislocated backward, a large amount of callus had been thrown out, which made the operation a difficult and tedious one.

The patient did well after the operation; the wound healed promptly, and at the end of four weeks the patient had a fair range of motion in the new joint. The patient has remarkably free flexion and extension of the arm, also good supination and pronation, and as the result of operation has attained a very useful arm.

## LOOSE CARTILAGE IN KNEE-JOINT.

Dr. H. R. Wharton presented a body removed from the knee-joint of a man aged twenty-four years, who for some years had suffered from a movable body in the left knee-joint which at times interfered with the motion of the joint.

Four years before he had wrenched his left knee by stepping upon a stone which rolled under his foot. After the accident the knee was bent, and could not be straightened. This condition existed for four months; at the end of this time he regained use of the knee-joint, but noticed the presence of a body which moved about in motions of the joint, and at times entirely disappeared. At times its presence caused him more or less disability.

There was no difficulty in locating the position of the body and removing it.

The case is of interest in that it points to the possible traumatic origin of some cases of loose cartilages in the joints.

## UNUSUAL SYMPTOMS ACCOMPANYING A SMALL OVARIAN CYST.

DR. JAMES M. BARTON presented a small ovarian cyst removed from a woman, aged twenty years, and weighing 257 pounds, who had been taken ill with vomiting and purging October 14, 1894. Previous to that date she was in perfect health, but during the five months since that date she had been seriously ill. She had had a very heavily-coated tongue, a foul breath, and constant nausea. Her temperature varied from 99° to 100° F., and occasionally rose to 101° and 102° F. She had lost exactly fifty pounds in weight. There was great pain and marked tenderness in the right iliac fossa. She kept the right leg constantly flexed. She could straighten it; but, as it greatly increased the pain in the right iliac fossa, she would soon again flex it. The loss of appetite was so marked that frequently for several days in succession she took no food whatever. During a period of ten days in November she and her mother both assure me that she did not take a mouthful of food. Since then there were two other periods of eight days each in which she also took no food whatever. Some days she even took no water. She slept but little, owing to the constant pain.

The large amount of fat on the abdominal walls prevented anything being felt through them, though the patient complained greatly of tenderness when pressure was made in the right iliac fossa.

On vaginal examination a fluctuating, sensitive tumor was found low down in the right iliac fossa. It was some inches from the uterus, and, apparently, not connected with it.

At different vaginal examinations made during a few weeks the tumor occupied different positions; usually it was found low down in the right iliac fossa, twice it was in the median line, once to the left of the median line, and twice it could not be felt at all through the vagina. The maximum tenderness was always over the tumor when it could be found.

The patient was regular in her menstruation, her periods occurring every twenty-one days. Her bowels were slightly constipated, but were otherwise normal.

At the operation, March 3, 1895, the growth was found to be a kidney-shaped multilocular cyst of the right ovary, a little larger than an adult fist. There were two points of strong omental adhesion, and the pedicle was nearly four inches in length.

The parietal peritoneum at the lower part of the incision, which was a median one, was greatly thickened, though not roughened or discolored. There were a few ounces of fluid in the peritoneal cavity. The appendix and its surroundings appeared to be in a normal condition.

There was no twist of the pedicle, and the strong omental adhesions, which evidently had existed for some time, would have prevented any great rotation of the tumor and pedicle.

NOTE.—March 28, 1895. The above described case made an uninterrupted and complete recovery, and is now sitting up daily for some hours. All of her symptoms have left. Her appetite is good, there is no nausea, she sleeps well, and there is no tenderness in any portion of the abdomen. She is able to extend the leg fully and keep it extended indefinitely without discomfort.

## DISLOCATION OF THE HEAD OF THE HUMERUS COMPLICATED WITH IMPACTED FRACTURE OF ITS ANATOMICAL NECK.

DR. JOHN B. ROBERTS related the case of a boy, aged nine years, who had fallen and struck his shoulder against a wall ten days before he was brought to his clinic at the Woman's Hospital. Two days before Dr. Roberts saw him he had been brought to the hospital, and Dr. Anna M. Fullerton, with Dr. Marie K. Formad, had examined him under ether and reduced what seemed to be a subcoracoid dislocation of the head of the humerus. Both of these physicians were struck by the flattened appearance of the deltoid region, and say that the bone distinctly snapped into place during the manipulations which they made. They could subsequently put the boy's hand on his head and on the opposite shoulder. These positions could not be given the bone before etherization and reduction of the dislocation. When seen by Dr. Roberts the acromion was unduly prominent. The left humerus was apparently half an inch shorter than the right, and the width of the upper end was markedly increased. The greater tuberosity, which could be easily felt, for the boy was not very fat, rotated when the lower end of the humerus was grasped and given a rotary motion. The head of the bone, in its normal position, also moved during this manipulation. At times a grating like that of a crepitus could be felt, but this did not seem to pertain to the humerus so much as to the scapula. It seemed to be in the posterior portion of the joint; but he could make out no fracture of the neck of the scapula, as was suggested by the situation of the grating.

The boy could voluntarily move his arm upward and outward without pain, though these movements were made in a guarded and careful manner, as though he feared suffering. The movements were very extensive, but showed that the continuity of the humerus was maintained.

Under ether, rotation of the lower end of the humerus caused similar motion of the head of the bone, but if he held the head still with his left hand, he could, by means of his right hand holding the shaft of the humerus, cause a bending or rocking motion between the head and the shaft. This movement was between the greater tuberosity and the head. It was apparent that there existed a connection between the shaft and the tuberosity, and also between these portions of the bone and the head; but an antero-posterior rocking motion could be made between the shaft and tuberosity on the one hand and the head on the other. There was no fracture of the neck of the scapula and no dislocation of the head of the humerus.

Three conditions were suggested by these symptoms: (1) A firmly impacted fracture at or near the anatomical neck, which allowed the whole bone to move when rotary motions were given to the shaft of the humerus, but which permitted bending between the head and greater tuberosity. (2) A partial or green-stick fracture at or near the anatomical neck. (3) An epiphyseal separation of the head with impaction. The fracture, whether impacted or of the green-stick variety, had permitted the dislocation, which also existed originally, to be reduced under ether by Dr. Fullerton and Dr. Formad. The rigidity maintained at the seat of fracture had been sufficient to permit the head of the bone to be put in place by leverage obtained from the shaft of the bone. The manipulations needed to reduce the luxation were not forcibly made, and the replacement was easily accomplished. Hence, the fracture could not have been produced by these efforts.

The widening of the upper end of the humerus, which was very conspicuous, and the apparent shortening of the humerus, inclined Dr. Roberts to the theory of impacted fracture. The age of the child suggested, however, a green-stick fracture as a possibility. By forcible manipulation he obtained complete separation of the fragments. The sensation imparted to his hands was that caused by disentangling or breaking apart two pieces of bone. Subsequently the arm assumed the usual appearance of a fracture of the humerus close to the shoulder-joint. The crepitus originally felt in the vicinity of the scapula was probably due to the rough edges of the firmly impacted fracture rubbing against the border of the glenoid cavity. Having become convinced of the diagnosis, and having restored the proper conformation of the shoulder, he dressed the injury in the usual way,—with a small pad in the axilla and a bandage to hold the arm to the thorax, which acted as an internal splint. . . . Union took place promptly. When last seen the boy, about eight weeks after the first examination, had a little unnatural prominence of the acromion, and the head of the humerus seemed to project forward a little more than usual. These appearances may have been due to atrophy of the deltoid. The movements of the joint were perfect.

Dr. Barton said that a case of epiphyseal fracture would present many of the points which are reported in this case. The fracture need not have been complete; but the prominence of the shoulder and other features are alike. Of course, Dr. Roberts did not see the case at this point, and could not positively determine whether there was complete separation or not.

# TRANSACTIONS OF THE SECTION ON GENERAL SURGERY OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA.

*Stated Meeting, January 11, 1895.*

JOHN B. ROBERTS, M.D., President, in the Chair.

## DRAINAGE-TUBE FOR CASES OF EMPYEMA.

DR. DAMASO T. LAINÉ exhibited a self-retaining drainage-tube for the treatment of empyema, and illustrated its construction and introduction by diagrams upon the black-board.

DR. THOMAS G. MORTON said that he had never used ether or other form of anæsthetic in any of his cases of tapping the chest. The operation is not attended with much pain and is quickly done, and he looks upon the use of an anæsthetic as dangerous. He does not use cocaine either, for the same reason. In the case of children, he applies ice as a local anæsthetic and generally finds it sufficient. Then, with regard to the material from which the canula is to be made, he thinks that rubber is the poorest that could be selected, because it so easily bends. He presented a self-retaining silver canula, which he had used for some years with complete satisfaction. It has a little shoulder, or projection, which prevents its slipping into the chest. The objection to the instrument exhibited by Dr. Lainé is that the openings are too small, they are liable to become clogged up and prevent free drainage.

DR. WILLIAM J. TAYLOR asked Dr. Lainé if he did not experience some trouble in getting in the very large shoulder of his instrument; it would seem as if the wound must be made unusually large, and that an unusual amount of pressure would be required in order to introduce this tube. Personally, he had never used anæsthesia for operating for empyema. Of course, where resection of the rib is required, he had used anæsthetics.

DR. DAVIS remarked that there were different methods of carrying out the same idea. In tapping the chest and securing drainage, he thought that it was extremely desirable to accomplish just what Dr. Lainé had attempted by his instrument. But it is applicable only in a limited number of cases. In many cases the ribs are so close that they will pinch the drainage-tube: unless resection is practised. Where the ribs nearly touch, the insertion of any instrument would cause considerable pain. He did not believe in jabbing a trocar into the chest—in abscess it is different—in cases of empyema; he preferred to make an incision and introduce a dilating forceps, and by working this between the ribs, get into the cavity with a free opening. He thought it wise to then introduce a finger to assure one's self that there were no fibrous bands binding the lung to the chest-wall. If any are found, he breaks up such bands with his finger and thus insures free drainage. If one cannot secure free drainage without resection of a rib, then that operation is to be performed. The instrument of Dr. Lainé is all right, as it is protected to prevent its slipping into the chest cavity, to which accident ordinary trocars are extremely liable. I have had to remove several from the pleural cavity.

Dr. Roberts said that in opening the chest, he personally had used ice to procure local anæsthesia. He then made an opening and introduced his finger and broke up adhesions. He then introduced a forceps and carried in a rubber drainage-tube, as described by Dr. Davis. He recalled a case a few years ago in which he had to trephine a rib in order to get out a silver drainage-tube.

Dr. Lainé added that he believed it to be recognized that, in empyema in children, simple tapping will be sufficient to cure. In cases of adults, where it is necessary to introduce a drainage-tube, it should not be so large as to bear upon the ribs; if it does, it will cause pain and the patient will not tolerate it long. As regards the rubber drainage-tubes, he thought favorably of the use of a short piece of rubber tubing, which is cut at the extremity into three pieces, two long and one short; the latter is fastened to a metal ring. This tube is carried into the chest with the forceps. To the long ends are fastened two long silk threads, which pass through the ring and the tube, and are fastened around the sides of the chest. This device prevents the tube from slipping into the chest, and it is very simple, being only a piece of ordinary French tubing.

He was a firm believer in resection of the rib in empyema of tubercular origin.

With regard to washing out the chest, he recalled two cases of death occurring during this operation. In fact, he thought that washing out should not be undertaken except in very old tubercular cases. He also recalled a case of tapping the chest cavity, followed by daily washing out of the chest, where, two weeks after the tapping, one morning, when the chest was being washed out, the lady died in her chair; this case had not been previously reported.

Dr. Thomas G. Morton recalled a case of a lady who, while he was tapping her chest, died after about a pint had been withdrawn. This was the only case of death that he knew of after the operation, and she was in very bad condition for operation. He was very fond of making a counter-opening above and passing the drainage-tube through both, so that the fluid passes into the upper and out the lower opening. He had never known any accident to occur, of the kind mentioned, after washing out the chest, at the Pennsylvania Hospital.

Dr. G. G. Davis said that he was passing through a hospital ward once when a resident and a nurse were washing out the chest of a man who had been tapped for empyema. The resident was injecting the fluid with a syringe and only about two ounces had been thrown in, when the man became pale, made a couple of gasping inspirations and died then and there. He would not have been surprised if death had occurred upon the operating-table, for the surgeons, fearing to use an anæsthetic, had produced local anæsthesia by injecting cocaine, which itself is a dangerous agent. Réclus may not have had any deaths from it in his own practice, but he reported to the French Academy of Surgery a case occurring in one of the districts of France, where death followed the injection of cocaine into the bladder. Personally, if he wanted to operate in a doubtful case, he should prefer chloroform to ether; but he would stop the inhalation as soon as his finger entered the chest cavity, which would require very little of the anæsthetic. With chloroform, there are none of the respiratory troubles that ether provokes, and the instrument is easily passed in.

In some patients, the operation may be done for relief from pressing symptoms. In a case, in which he operated some time ago, in which there was probably a carcinomatous process going on, he was requested to operate by the physicians in charge, but the patient was so low that he thought it looked extremely doubtful whether any operation would be justifiable or not, or, indeed, that she would survive it. Yet she did for a period of three weeks afterwards, and he was assured that it had added very much to her comfort. It is, therefore, justifiable to operate even in cases that are going to die, if you can add to their comfort.

DR. A. B. HIRSCH described a device for retaining a drainage-tube and preventing it from passing into the chest, made by him some time since. He took the calibre of a drainage-tube and had a neighboring jeweller make a silver tube with a flange, having perforations upon opposite sides. After inserting the tube, ligatures were passed through the perforations and attached to the skin. This worked very well.

## TREATMENT OF TUBERCULAR ABSCESS.

DR. WILLIAM J. TAYLOR read a paper on "Treatment of Tubercular Abscess." (See page 104.)

DR. LAINÉ remarked, regarding Halsted's subcuticular stitch, that he was much amused while in Paris at hearing a certain professor claim it. But on looking up the matter he found that the credit of priority is due to an Irish physician living in the south of Ireland.

DR. THOMAS K. MORTON said that he would like to know where Dr. Taylor makes his incision, through the thin part or at the side through healthy tissue? His own experience had not been very favorable as regards primary union. Probably he used too strong a solution of bichloride, which caused increase of discharge.

DR. J. M. BARTON had been in the habit of using the method described by Dr. Taylor for a couple of years past, and had found it to answer the object according to the case. If the case has been a comparatively recent one, he had had good results from the operation. In cases with cheesy masses and characteristic pus, and in open abscess, this method seems the only practical method and is fairly successful. But when the abscess is undergoing comparatively rapid change, as in hip-joint cases, it must be laid open and drained. The operation recommended in the paper is limited in application to old cases of abscess and to open abscesses of comparatively slow cell-growth.

DR. TAYLOR rejoined that he did not claim that primary union can be had in every case, and in the character of abscess of which Dr. Morton spoke, with rapidly-formed fluid and very thin walls, there is, of course, very much less chance of primary union than in cold abscess. For that reason he advised early opening of tubercular abscess, just as in ordinary abscess. He had always gone in at the centre of the most prominent part of the swelling and had not made the opening at the side. Just at present, he had two cases under observation, both of tubercular abscess of comparatively slow growth. In the first one he removed the dressing at the end of eight days; at the end of the first twenty-four hours there was a comparatively free discharge from one point of the wound, but after this the wound closed absolutely, and from that day to this, a period of about three months, there has been no discharge whatever. In the other case, also a child, he got primary union, though he did not expect it. The tissues had softened down very much and the skin was thin. He did not make subcuticular stitches in this case. In cases of lumbar abscess and slowly-forming hip-joint abscess he got good results. In this way one gets rid of cheesy matter and small spicules of bone, and by using the drainage-tube for the first twenty-four hours one gets perfectly good results.

## CYST OF HERNIAL SAC.

Dr. John B. Roberts presented a cyst obtained from a case of femoral hernia, adding that in several cases upon which he had operated for radical cure of femoral hernia, when he had cut down to the sac, he had found a cyst containing fluid. He wondered whether or not these were cases in which a truss had caused obliteration of the opening into the abdominal cavity, by constant pressure, and had produced cystic degeneration. However, in two cases operated upon a few days ago, he had found a sac of this consistence in connection with the femoral ring, and, on inquiry, found that neither of these patients had ever worn a truss,—the radical cure had been obtained without a truss. He dissected carefully the sac from the hernial ring and put a pair of forceps through the opening into the peritoneal cavity. The sac completely filled the femoral opening. He did not open the cyst, but preserved it for presentation. It is curious as a natural truss filling the ring and extending into the femoral canal, preventing the descent of intestine. The cyst was movable, but could be pressed up against the ring.

Dr. Morton said that he had never seen such a cyst in these cases, but in a case operated upon by Dr. Hunt there was a cyst in which echinococcus hooklets were found in the fluid. The hernial sac seems a favorite place for the development of the echinococcus.

# EDITORIAL ARTICLES.

## BOECKEL ON RESECTION OF THE KNEE WITHOUT DRAINAGE.

JULES BOECKEL, of Strasburg,[1] reports sixty-four cases of resection of the knee without osseous sutures, without ligatures, and without drainage. The experience of this surgeon has been a large one in this particular field, and he has embodied his results in a series of articles already published.[2] This new series gives the results of the operation without drainage in sixty-four cases out of a total of 125 cases which he has operated upon.

The first case in which drainage was omitted was in 1888. He arrived at this by several successive steps; first omitting the suture of the bone, then the ligatures, and, finally, the drainage. A summary of his method of operation is as follows:

The first incision is a curved one passing above the patella and opening into the joint. Flexion of the knee. Division of the ligaments, first of the crucial and then of the lateral; the joint can then be widely exposed. Resection of the articular surfaces, varying in extent according to the lesion present, and as small in amount as possible in children. Resection of the knee-pan and a careful extirpation of the synovial membrane and of all parts in the neighborhood which show pathologic alterations. Incisions for the purpose of drainage occasionally are necessary. Disinfection of the field of operation and of any fistulous tracts which may be present. Fixation of the leg upon a splint and coaptation of the osseous surfaces. No osseous sutures and no ligatures. Suture of the skin-wound by deep sutures emerging one to two centimetres from the edge of the wound. No drainage except occasionally a temporary one kept in place only during the application of the suture. Withdrawal of the drains *before* the application of the dressing. Dressing of iodoform gauze, and finally a removal of the Esmarch bandage. Vertical elevation of the limb for twenty-four hours.

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[1] Archives provinciales de Chirurgie, January, 1895.

[2] Bull. de la Soc. de Chir., 1881, and also 1889; De la résection du genou, Paris, 1889, F. Alcan; French Congress of Surgery, 1891; Congress of Rome, 1894.

This dressing remains in place for from four to five weeks at least, at the end of which time the wound is healed. The sutures are then removed. To complete the cure it is only necessary that a dressing of silicate of soda should be applied, which is to be worn several weeks or months according to the age of the patient and the degree of consolidation. The patients can then begin to go about with the aid of crutches, or in some cases with only a cane.

These steps, thus concisely summarized, are practically those which were applied in all of the sixty-four cases which Boeckel last operated upon.

The age of the patients, the nature of the lesions present, the immediate results, the permanency of cure, and the final results are summarized as follows:

*Age.*—2 children less than two years.
21 children between four and fourteen years.
12 adolescents between fifteen and twenty-five years.
10 adults between twenty-six and fifty years.
10 adults between fifty and sixty years.
9 old persons between sixty and eighty-two years.

*Nature of the Lesions.*—One case of arthritis deformans of the knee-joint; one case of a pseudo-arthrosis after a primary resection. These two operations were made upon the same subject.

Eight cases of osteo-arthritis of a chronic type, which had been cured, but which had resulted in a vicious ankylosis requiring an *orthopædic resection.*

Fifty-four cases of tuberculous osteo-arthritis, twenty-six of the osseous form and twenty-eight of the synovial form.

Of these fifty-four cases, forty-one had suppurated before the operation was performed; thirteen had not. The joint contained fungosities but no pus.

*Immediate Results.*—The sixty-four resections were all cured under the single operative dressing with one exception. This case was that of a young girl, nine years of age, very poorly nourished, and suffering from a vicious ankylosis as a result of an osteo-arthritis in infancy. A partial gangrene of the skin developed, which led to suppuration within the joint for two months, and to a fistula which lasted for ten months. Four operations healed under a single dressing, but with fistulas persisting for two years, fifteen months, eight months, and four months respectively.

Fifty-nine were healed without any suppuration and without a fistula persisting.

The removal of the dressing and the immediate application of the silicate splint in the sixty-three cases were as follows: From the nineteenth to the thirty-first day, in thirty-eight cases; from the thirty-second to the forty-ninth day, in twenty-five cases.

The length of time that the patients remained in the hospital was, therefore, from three to four weeks in the most rapid cases, and from five to seven weeks in the slower ones. The first of these as a class were young persons and children; the second were adults and old persons. In this last class of patients Boeckel is in the habit of delaying the removal of the first dressing in order that the consolidation may be further advanced. This fact explains the difference in the duration of the treatment.

*Ultimate Results.*—Of this series of sixty-four resections, four have died from intercurrent affections; one from acute mania after two months; one from pneumonia following the grippe after two months (this was a woman eighty-two years of age); one from dropsy after fifteen months; one from senile cachexia three years after the operation, a woman of seventy-eight years.

Two cases were submitted to an amputation after four and six months respectively, on account of the recurrence of fungosities making a new resection impossible.

When the *functional results* are considered, omitting the two cases of amputation just mentioned, in the sixty-two cases sixty resulted in ankylosis with the leg extended, and two in pseudo-arthroses. These last were both in the same patient. The original operation was done to cure arthritis deformans; a pseudo-arthrosis resulted, and a second operation gave the same result.

As for the patients in general, omitting the four mentioned above who died, the two cases of amputation, and one case who died of phthisis since the operation, the fifty-six who remain may be summarized as follows:

8 were operated upon six and one-half years ago.
9 between five and one-half and five “
10 “ four “ “ “ four “
5 “ “ “ three and one-half “
7 “ two “ one-half and two “
1 twenty-one months ago.
1 nineteen “
2 seventeen “
1 sixteen “
2 fourteen “
1 twelve “
1 eight “
1 five “
3 four “

A positive cure has been obtained in two-thirds of all the cases operated upon. As for the others, it is perhaps a little too early to express a positive opinion, although in nine of them the operation was done nearly two years ago, and thus far there has been no recurrence. In those of a more recent date it is to be hoped that, as in the other cases, the resection will have saved not only life, but will give them a useful limb, quite able to perform any task that may devolve upon it.

H. P. DE FOREST.

# INDEX TO SURGICAL PROGRESS.

## GENERAL SURGERY.

**I. Glycerin Intoxication after Injections of Iodoform and Glycerin.** By Dr. LEOPOLD SCHELLENBERG (Breslau). Since 1866, when Husemann found glycerin to have a poisonous action on frogs, we have increasing evidence of its toxic action. The symptoms vary with the amount of the dose, but in general they consist of frequent pulse, rise of temperature, paralysis of the muscles, congestion of the kidneys and hæmoglobinuria. Most of the cases reported have been caused by injecting glycerin into the womb to bring on labor.

The author has observed twenty-one cases of glycerin-poisoning in children in whom iodoform and glycerin had been injected for tubercular disease. The cases can be divided into the following groups according to their clinical symptoms:

(1) *Mild Cases.*—Several hours after the injection a slight rise of temperature occurs, the pulse becomes rapid, and the patients have a little pain at the site of the puncture. The urine is high-colored, containing a little hæmoglobin. No blood-cells, casts, or renal epithelium present. There is a little albuminuria which continues longer than the hæmoglobinuria. After about twenty-four hours the symptoms disappear and the urine returns to normal.

(2) *Severe Cases.*—The temperature and pulse are more affected than in the previous cases. The patients have a peculiar pale, sallow complexion, and present nervous symptoms which make one think of meningitis. The urine is of a dark-brown color and deposits a copious dark sediment in which are found renal epithelium casts covered with colored granules and detritus. The hæmoglobinuria disappears after fifty-six hours or before. There are no blood-cells present.

(3) *Fatal Cases.*—One case of this kind was observed. The symptoms were similar to those of the previous group. The patient went into collapse soon after the injection and died on the third day. The autopsy showed acute parenchymatous nephritis and œdema of the meninges. The kidneys were filled with hæmoglobin.

Undoubtedly, the iodoform produced or augmented some of the symptoms in the severe cases, but they are not to be looked upon as cases of iodoform-poisoning, as the kidneys were the organs most affected, and iodoform produces no kidney lesion, moreover iodine could not be detected in the urine in some of the mild cases, and when it was present it usually appeared some time after the hæmoglobinuria.

It is not improbable that the acute nephritis caused by the glycerin prevents the excretion of the iodoform and thus augments its toxic effects.

The conclusions reached are as follows:

(1) The danger of glycerin-poisoning increases with the quantity of the drug, the tissue, and pressure. Children are poisoned by relatively smaller quantities than adults.

(2) A dose of ten cubic centimetres in children and twenty cubic centimetres in adults is almost always well borne.

(3) Poisoning is easily produced by parenchymatous injections.

(4) In cold abscesses with a pyogenic membrane three or four times as much can be injected as is permissible in other parts.

(5) Fresh wounds and large joints are especially liable to absorb the drug.

It has been proposed to give up the use of glycerin, substituting olive oil for it, but the therapeutic effect of that mixture has been found much inferior to iodoform and glycerin.—*Archives für klinische Chirurgie,* Band XLIX, Heft 2.

**II. Traumatic Origin of Tumors.** By Dr. CARL LOWENTHAL (Munich). The author has gone over the literature of this subject and has collected reports of 800 tumors which show traumatic origin; 750 had already been published and 50 new cases are added. A short history of each case is given and numerous tables and analyses are made.

The kinds and locations of the tumors may be seen from the following table:

| Kind of Tumor. | Number of Individuals. | Head. | Face. | Neck. | Breast. | Back. | Abdomen. | Urinary Organs. | Genital Organs. | Pelvis and Lumbar Region. | Upper Extremity. | Lower Extremity. | Multiple Tumors. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carcinoma | 358 | 16 | 103 | 1 | 152 | 2 | 8 | 15 | 17 | . | 18 | 26 | . |
| Adenoma | 10 | . | . | . | 9 | . | 1 | . | . | . | . | . | . |
| Fibroma | 21 | 3 | 2 | 1 | 3 | 2 | 2 | . | . | . | 4 | 4 | . |
| Lipoma | 16 | 5 | 1 | 1 | . | 1 | . | . | . | . | 6 | 2 | . |
| Myxoma | 8 | 3 | . | . | . | . | 1 | . | 1 | . | . | 3 | . |
| Chondroma | 27 | . | . | . | 4 | . | . | . | 2 | 2 | 9 | 10 | . |
| Osteoma | 18 | 1 | 2 | . | . | . | . | . | . | 1 | 3 | 11 | . |
| Angioma | 5 | . | 2 | . | . | . | . | . | . | . | 2 | 1 | . |
| Myoma | 2 | . | . | . | . | . | . | 1 | 1 | . | . | . | . |
| Glioma | 11 | 11 | . | . | . | . | . | . | . | . | . | . | . |
| Neuroma | 8 | . | . | . | . | . | . | . | . | . | 6 | 2 | . |
| Sarcoma | 316 | 54 | 24 | 9 | 30 | 7 | 8 | 4 | 21 | 12 | 42 | 103 | 2 |
| Total | 800 | 93 | 134 | 12 | 198 | 12 | 20 | 20 | 42 | 15 | 90 | 162 | 2 |

While carcinomata are more often produced by chronic irritation than by sudden injury, still, cases of the later class are by no means rare. Among 934 cases of carcinoma of the breast reported by various authors 125 or 134 per cent. gave a history of traumatic origin.

After excluding all doubtful cases the well-authenticated cases showing traumatic origin may be divided into two classes: those in which a wound does not heal, but takes on cancerous ulceration, or after healing the scar forms a cancer; and those in which a cancer develops at the exact site of an injury which left no wound.

Of the 316 cases of sarcoma reported 216 were in the male, 97 in the female, the differences in the two sexes is due to the fact that the male is more exposed to injury.

The length of time between the injury and the appearance of the tumor varies from a few days to forty-nine years. In a number of cases old scars have developed into sarcomata many years after the original injury. Among 190 cases 135 developed within a month after the injury, 33 inside of a year, and 22 after a year.

From this great quantity of material the author thinks there can be no doubt that a trauma can give rise to a tumor, malignant, or otherwise, either by stimulating misplaced embryonal tissue to more active growth, according to the theory of Cohnheim, or by so changing the nutrition of normal tissue that it takes on a pathological growth.—*Archives für klinische Chirurgie*, Band XLIX, Hefte 1 and 2.

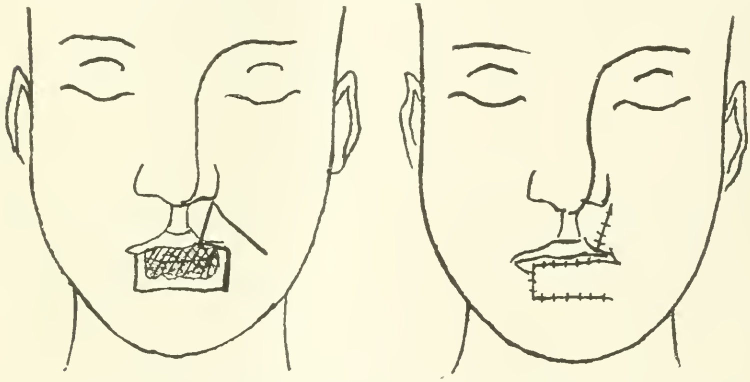
GEORGE R. WHITE (New York).

## HEAD AND NECK.

**I. A Method of Cheiloplasty by Borrowing from the Healthy Lip.** By Dr. LARGER (Paris). The author, for the purpose of supplying the defect left after the removal of an epithelioma involving the left two-thirds of the lower lip, devised the following method:

He split the diseased lip vertically on either side of the growth, the incision to the left beginning at the commissure, that of the right from the point of union of the left three-fourths with the right fourth of the lower lip. These two perpendicular incisions were connected by a horizontal incision at the level of the labio-mental furrow. To fill the gap caused by the removal of the portion thus cut out, he procured a flap from the upper lip by an incision which, starting from a point at the junction of the left third with the right two-thirds of the upper lip, extended towards the border of the left wing of the nose, involving the whole thickness of the lip, up to and including the cul-de-sac of the buccal mucous membrane. This incision, starting from its upper extremity, was then directed outward and downward, parallel to the naso-labial groove, to a point on the cheek a little below the level of the left labial commissure.

The flap thus formed has a free blood-supply and falls naturally, without appreciable twist, into the gap in the lower lip. Owing to the elasticity of the tissues of the lip and the freedom of the return circulation in the flap, it is possible to cut this flap smaller than the gap to be filled, contrary to the usual need in plastics. The mucous covering of the lower edge of the flap must be dissected off and then the flap is sutured in place. Along the upper border sufficient of its substance is grooved out to allow of the buccal mucous membrane to be sutured to the skin, and thus a mucous covering obtained for the new lower lip. Finally, the incision in the upper lip is sutured vertically to that in the cheek, thus closing the hiatus left by cutting out the flap. Two additional points of suture serve to form the new left commissure.



In the particular case in which this method was employed by the author, the result was very satisfactory. There was no swelling of the flap; the teeth were well covered; the projection of the two lips was uniform. The regularity and symmetry of the mouth left little to be desired. The saliva was absolutely retained by a contractile lip, and in both mastication and phonation the mouth worked normally.—*Bull. et Mém. de la Soc. de Chirurgie de Paris*, 1894, t. xx, p. 643.

**II. Congenital Epithelial Cysts and Fistulæ of the Neck.** By Dr. O. Hildebrand (Göttingen). The author reports twenty cysts and ten fistulæ of the neck observed at the surgical clinic in Göttingen.

The cysts were not congenital in the sense that they could be seen at birth, but developed gradually and were first observed between the ages of twenty and forty years. They were usually situated in one of the carotid triangles. One only was placed in the median line. Anatomically, these cysts are divided into different groups. The large majority had thick walls and contained opaque mucoid material. The interior resembled mucous membrane in appearance, and had numerous hemispherical elevations on the surface. Microscopically, the walls were found to be composed of flat epithelium resting on a layer of columnar cells. Under this was a layer of loose connective tissue in which were many lymph-follicles. Outside of this was a thick wall of connective tissue. Some of the cysts contained ciliated epithelium and some mucous glands.

Another class of cysts contained hair, sebaceous glands, and other structures characteristic of dermoids.

Of the ten fistulæ all but two were at the side of the neck, and in six of these eight the external opening was between the hyoid bone and the clavicle, and internal to the sterno-mastoid muscle. The interior of the fistulæ showed flat epithelium near the periphery, but deeper they were covered with ciliated epithelium. The inner opening of the fistulæ was usually somewhere in the pharynx. The two fistulæ which occupied the median line terminated internally at the base of the tongue. One contained thyroid tissue in its walls.

The inner openings of these fistulæ indicate from which branchial cleft they originated, and since most of them terminate near the fossa of Rosenmüller, just back of the opening of the Eustachian tubes, it is thought that most of the fistulæ, as well as the cysts, come from the second branchial cleft. The fistulæ are due to a failure of one of the branchial clefts to close and a breaking down of the septum usually closing these structures. When a cyst is present the septum is supposed to remain intact and the inner or outer end of the fistula is closed. In the former case the cyst lies next the mucous membrane, and its internal lining resembles the covering of the pharynx or the tonsil. If the cyst form between the septum and the skin, it must originate entirely from the ectoderm and will be a dermoid. The cysts and fistulæ in the median line are from the ductus thyroideus, the duct from the foramen cæcum in the tongue to the thyroid gland.

**III. Congenital Cystic Tumors of the Coccygeal Region.** Six tumors have been observed in the coccygeal region, all but one of which were present at birth. They were situated between the rectum in front and the sacrum and coccyx behind. Some were intimately connected with the rectum, but not with the bone. There were three distinct kinds of cysts observed: lymphangiomæ, dermoids, and cysts with epithelium resembling that of the intestine at some period of its development. Cysts of the latter class are most frequently met with. They are usually multilocular, contain opaque mucoid fluid, and are lined with cuboid cylindrical or flat epithelium. Intestinal glands are sometimes present. The walls sometimes contain bone, cartilage, unstriated muscle, or material resembling the spinal cord.

An explanation of the occurrence of these cysts can be found in the fact that the canalus neurentericus occupies this region. The blastopore, the first external opening of the intestine, is situated at the tail-end of the medullary furrow. When this furrow is converted into a canal the opening can no longer be seen from the outside, but opens directly into the medullary canal, so that the intestine and medullary canal form a V-shaped tube. Later the neurenteric canal becomes obliterated. The chorda dorsalis appears between the intestine and medullary canal, and extending backward to form the sacrum and coccyx, completely separates the neurenteric canal from the spinal cord, causing it to lie in front of the coccyx. All the epithelial cysts of this region are due to a persistence of the neurenteric canal. The dermoid cysts are undoubtedly produced from that part of the canal formed by the ectoderm, while the others come from the intestinal end of the canal. Bone and cartilage in the cyst-walls are due to a displacement of some of the chorda dorsalis by the canal, and the presence of material resembling the spinal cord is easy of explanation. The origin of the lymphangiomata is still unknown.—*Archiv für klinische Chirurgie*, Band XLIX, Heft I.

George R. White (New York).

# REVIEWS OF BOOKS.

System of Surgery. Edited by **Frederic S. Dennis**, M.D., Professor of Surgery, Bellevue Hospital Medical College. Assisted by **John S. Billings**, M.D. Vol. I. The History of Surgery, Pathology, Bacteriology, Infections, Anæsthesia, Fractures and Dislocations, Operative Surgery. Philadelphia: Lea Brothers & Co., 1895.

The joint authorship of medical works is much in vogue at the present time. It has in its favor that, each subject is handled by the man deemed most capable of the work. Such an individual then can give his whole attention to a subject upon which he is most competent to write; and the reader reads with a feeling that the contribution is authoritative. Such a work, as a whole, carries with it an encyclopædic importance. Its circulation is larger because the professional interest in its authorship is more widely distributed. In all works on surgery written by a single individual, the author writes of many things of which he has no great personal knowledge; and his book will be sold to men at whose feet he might sit for instruction in many of the subjects upon which he has written.

The System of Surgery which now lies before us is a beautiful example of these principles. If they are as well carried out in the succeeding volumes as they have been in the first the work will be a distinguished success. As is remarked in the preface, the whole is the work of American surgeons, and it may be fairly said to represent the most advanced condition of American surgery.

Volume I opens with a chapter on the history and literature of surgery by John S. Billings. The author states that the most he can hope to accomplish in this paper is to furnish to the physician who has little time, taste, or opportunity for consulting the original documents the means of ascertaining the periods and places at which the leading surgeons of the world have done their work. But he has accomplished more than this : he has furnished a chronological list of great historic value of all of the world's prominent surgeons with a brief statement of their work and character, all interspersed with concise and interesting comments, so that the paper as a whole constitutes a most finished and delightful essay. Dr. Billings has accomplished a task which represents a vast amount of work. His paper is the best of the sort that it has been our pleasure to read, and merits the highest of compliments.

The chapter on surgical pathology, including inflammation and the repair of wounds by Councilman, is well written, and embodies the most modern teaching.

Welch has contributed a chapter on the general bacteriology of surgical infections. It treats of the peculiar bacteria found normally in the various cavities and parts of the body. The sources and manner of infection are there discussed in a manner that shows a very practical knowledge of this department of surgery. The conditions favoring the development of surgical infections are admirably presented. Lastly is a general consideration of pyogenic bacteria, and a description of the leading characters of the bacteria concerned in surgical infections.

The chapter on the symptoms, diagnosis, and treatment of inflammation, abscess, ulcer, and gangrene by Nancrede, disposes of its subjects in rather short space, and contains little that is new. Such an important subject as that of burns is spoken of but briefly. Traumatic hysteria, which has but recently appeared in literature, is well described.

Carmalt gives a good description of septicæmia and pyæmia ; and Biggs contributes a well written chapter on rabies.

The chapter on gunshot wounds, by Conner, is notable and important, because it deals with the new fire-arms, the effects of which are so very different from those of the weapons which have usually been described in former works.

The chapter on fractures and dislocations, written by Dennis, though presenting the subject in well-arranged and classical form, outside of the features concerning the treatment of open wounds, contains little to distinguish it from similar articles written ten years ago. Certainly, the surgery of fractures and dislocations was well developed ten years ago, but then the last decade has seen many valuable contributions. The illustrations in this chapter are good and instructive; many of them are new. "The treatment of fracture of the patella," says the author, "consists in the application of a suitable apparatus designed to bring into apposition the fragments." Of wiring the patella he rightfully says, "The operation is one about which much honest diversity of opinion exists." He gives a fair and impartial criticism of the operation; and among his concluding remarks states that, "it is not an operation which can be indiscriminately performed, and never by an ordinary practitioner with little surgical experience and with little faith in the germ theory of inflammation."

The operative treatment of congenital dislocation of the hip, of which so much has recently been written and which has been so successfully carried out, is quite ignored. The ambulant treatment of fractures of the leg, to which the German surgeons have given much attention and which figures prominently in the recent German text-books, is not even mentioned. The iniquitous hooks of Malgaigne and the antiquated adjuster of Jarvis are described and pictured.

The use of the plaster of Paris is not given the prominence in the treatment of fractures which it merits. Instruments for reducing dislocations are illustrated and described, and then summarily dismissed because their employment has been abandoned.

Among the chapters especially deserving of comment is that by Horatio C. Wood upon anæsthesia. It is concise, but still the most finished and scientific contribution upon the subject that has appeared in our literature. The dangers of the use of alcoholic stimulants in cases of anæsthetic cardiac failure are emphasized. The use of digitalis and strychnine for such conditions is highly recommended.

Another admirably practical chapter is that by Gerster on the technique of antiseptic and aseptic surgery. He says, "Where mechanical and caloric measures are applicable and sufficient to the attainment of a state of freedom from micro-organisms, there we have *asepticism*. Where this is not the case,—that is, where, either on account of the inherent condition of the surfaces to be dealt with, or because of the low order of the conception of purity of the medical attendant, heat and scrubbing cannot or are not used to their full extent,—chemicals must be accepted as a makeshift, and the process is termed *antisepsis*." The very last sentence in the chapter may also be quoted, "As is seen from the preceding remarks, here also as elsewhere, mechanical processes of depuration constitute the main portion of disinfection." Of the surgeon, whose photograph appears on page 711, we can only say it is a fearful and wonderful object.

Stephen Smith has contributed the part on operative surgery, and gives well-illustrated descriptions of the amputations especially. In this chapter, as in the chapter on fractures, are pictures of instruments which belong to the domain of history, and not to that of modern surgery. The chapter ends with a section on compensative appliances. The surgeon is urged to familiarize himself with such apparatus so that he may more intelligently fashion his stumps, and so that his patient shall not be left to the mercy of the manufacturer.

The book, as a whole, is characterized by the absence of irrelevant material. The articles are generally concise, and questions of history are given but little space outside of the chapter on that subject.

A noticeable feature is that the heading of the chapters does not give an adequate idea of what the chapters contain. For example, the chapter entitled, "Symptoms, Diagnosis, and Treatment of Inflammation, Abscess, Ulcer, and Gangrene," contains the section on the varieties and treatment of wounds and contusions. It also contains sections on "Traumatic Delirium," "Traumatic Hysteria," "Hæmorrhage," and "Hæmophilia." The chapters entitled, "Gunshot-Wounds," contains sections on "Sword and Bayonet Wounds," and "Arrow Wounds." Fractures and dislocations are described under "Fractures."

The work is well printed and handsomely illustrated, and promises to be a valuable addition to the world's systematically-compiled surgical literature, and an aid to the student, practitioner, and teacher. The names of the men who are to make the three succeeding volumes guarantee that the work will be one that shall redound to the credit and honor of American surgery.

James P. Warbasse.

Medical Gynæcology: A Treatise on the Diseases of Women from the Stand-Point of the Physician. By Alexander J. C. Skene, M.D. 8vo, pp. 530. New York: D. Appleton & Company, 1895.

A more accurate description of the scope of this book by Professor Skene would be "A Treatise on such Diseases of Women as can be relieved by the Use of Medicine and Hygiene Alone."

It may be considered as a supplement to the larger work of the same author on "The Diseases of Women," published in 1889. Its composition has been prompted by a desire on the part of its author to present a conservative and judicial estimate of the extent to which purely medical and hygienic measures may be relied upon for the relief of the class of diseases treated of. Certainly no one could be better fitted for such a task than the eminent teacher and successful practitioner who has undertaken it, and whose methods of thought and of work had been established, and the foundation of his well-earned reputation laid before the newer pathology in the disease of the female pelvic organs and its more radical and exclusively surgical methods of treatment had gained much vogue. As the years have passed he has welcomed whatever proved itself to be of value in the new, while he has held fast to that which was good in the old. The present volume, therefore, ought to have special value in coming from such a source, representing the mature views of one of the senior workers in his chosen field, who has ever striven to hold a proper balance between conservatism and radicalism.

The first 200 pages of the book are devoted to topics that belong without question to the physician and the medical philosopher. They include such matters as differentiation of sex, including the hygiene and education of the growing girl, menstruation and its derangements, sexual characteristics, woman's function in life, therapeutic agents employed in the practice of gynæcology, hygienic and mental therapeutics, and derangements of the sexual function.

Chapter XVII takes up acute inflammatory affections of the pelvic organs, and at once the relative value of surgical and medical treatment engages attention. The author's judgment is expressed as follows: "My own opinion is that, so long as a case of pelvic inflammation is progressing so that there is no apparent danger to the life of the patient, and there are good prospects that recovery will come in time, medical care is most to be relied on; but when suppuration takes place, no matter where, in the pelvis, then surgery comes in to do what medicine cannot do. In cases that do badly, even when there is no certainty of the presence of pelvic abscess but a possible general septicæmia, surgical treatment is called for." "The occurrence of suppuration marks the boundary-line, as a general rule, between those that require medical treatment only and those that require both medical and surgical care. An exception to this rule is met when the damage done by the products of inflammation—such as adhesions—affects the functions of the pelvic organs so that the life of the patient is in danger or renders her helpless and useless, and medical treatment fails to give relief."

In chronic, non-specific endometritis, general medical treatment and the vaginal douche will suffice for a cure in some cases, but in most cases both medical and surgical treatment is required. Chronic ovaritis and chronic salpingitis (non-suppurative) may yield to prolonged medical treatment.

The treatment of displacements of the uterus belongs mainly to the surgeon, but recent displacements due to temporary enlargement of the uterus and defects of the uterine ligaments, and cases in which the uterus can be readily made to resume its normal position, are wholly within the province of the physician.

The chapter on diseases of the external genitals seems out of place in this book. The methods of treatment advised are all surgical in their nature, although of a minor order.

Functional diseases, hysteria, and neurasthenia, sex and its relations to insanity, all manifestly belong to medical gynæcology. The chapters devoted to their consideration are among the most valuable in the book. The affections of the mammary glands that the author considers to be within the scope of his work are of minor importance, being certain forms of maldevelopment, neuralgia, deranged secretion, and hyperplasia. Under the name of "areolar hyperplasia" the author describes what with more exact pathology would be more correctly designated as chronic circumscribed mastitis. This is certainly a distinctly surgical affection. The bromide of arsenic and iodide of iron or ammonium advised as an adjuvant to the topical applications mentioned serve only to satisfy the mind of the patient in such cases.

Nothing is said directly of the difficulty of distinguishing between this circumscribed mammary hyperplasia and incipient carcinoma. One is led to infer, however, that such differentiation is not easy from the fact that the author details two cases in which he supposed the disease to be cancer, but in which opinion he was proved later to have been in error. The only distinguishing mark here given is that in time the hyperplasiæ recover, while the cancers grow worse. The vitally important fact that by waiting for time to sufficiently reveal whether a given tumor in the breast is malignant or not, the possibility of its absolute and total eradication, should it prove to be cancer, may be lost, is not suggested at all. There is no general surgeon who does not often have to lament the evil results of this procrastination. Delay in seeking surgical relief for a tumor in the breast is more often than not under the advice of physicians, for the discovery by a woman of a hard lump in one of her breasts instantly awakens fear of cancer and sends her to her physician for advice. Were only a small proportion of such lumps the beginning of cancer, it were far better that wherever there was the slightest reason for doubt, extirpation should be at once resorted to, even though many indurations of simple inflammatory nature be unnecessarily removed, than to permit one malignant growth to remain unremoved. With great justice many women, who come too late to the operating-table with breast cancer that has diffused itself beyond the possibility of complete extirpation, reproach the physicians who, while they might have been helped, lulled them into a false security by holding out to them hopes that their trouble was not cancerous, advising delay and medical treatment.

It is to be regretted that in this book, which is sure to be extensively read, this view of the case had not been presented, and its very powerful influence had not been thrown upon the side of the early extirpation of every breast tumor about the nature of which the least doubt should exist.

As to uterine fibromata and cancer of uterus, ovaries, or breast, little in the way of medical treatment is suggested. In the course of the brief chapter devoted to cancer, he makes the new, and, if true, very important statement that at the time of the menopause *lithæmic* patients—that is to say, women with renal and hepatic torpor—are predisposed to cancer ! Here is a new subject for collective investigation. He says, further, "It is a rare thing to see cancer in an active person who does not carry a superabundance of adipose tissue, and who takes a sufficient amount of muscular exercise, and yet not too much." Both these statements it would be difficult to substantiate ; certainly, it is by no means a rare thing to see cancer in the lean and active, and in those whose kidneys and liver are doing their full work. As yet no one can point out the signs that indicate a predisposition to cancer in a given case, and, certainly, no one can assert that by the taking of certain drugs, or the adoption of a certain regimen, a cancerous tendency has been aborted. And yet this is the very thing which the types make the author to assert, on page 367, where, after mentioning the use of arsenic, mercury, and iodine in conditions where he believed there was a predisposition to cancer, as well as in cases where cancer had actually appeared, he says, "These are the remedies that at the present time are the most efficacious, and I believe that if persistently continued, and if begun early in the course of the disease, but *more especially if employed where there is an apparent tendency to the disease* [italics ours], they are potential preventives." To this quite positive statement is appended the qualifying phrase, "at any rate, the best there are." With which we fully agree.

As to diseases of the urinary organs, the author states that although the majority of diseases of the urinary organs are of such a nature as to require surgical treatment, still there is a large class of acute and functional diseases in which better results are obtained by medical than by surgical treatment. In the quite full consideration of diseases of the urinary apparatus that follows we do not find any reference to affections of the ureters, and the key to certain otherwise inexplicable and inveterate bladder disturbances which they furnish when once they have been recognized.

The concluding chapters of the book are devoted to the diseases incident to the menopause and to advanced life. Of these the most important, medically, is senile endometritis. Its treatment is largely surgical, but is given in considerable detail because of failure to do justice to this affection in works on surgical gynæcology. Of especial interest is his remark that, "Fibromata of the uterus act as a very important cause of the affection, for, although uterine fibromata frequently disappear after the menopause, the endometritis which accompanies the neoplasm continues, but changes from a catarrhal to a purulent form." Such a remark is of especial significance coming from one who has been considered as claiming a comparative innocuousness for uterine fibromata. It will certainly add another indication to those already accepted by many as justifying an early removal of many uteri that are the subjects of annoying and growing myofibromata.

The book, as a whole, is a most interesting and valuable contribution to literature; its style is clear and simple, almost conversational, and easily calls up to mind the author as he stands before his classes and discusses with them in this same style the peculiarities of the cases he presents to them. The book will, after all, be of more value to the surgeon than to the physician; the latter needs rather to have brought sharply to his attention at times the limitation of his therapeutics and the necessity for the more radical and positive measures of the surgeon; the former will have the horizon of his professional life broadened by reading such a book as this, and to surgeons, especially to those who are tempted to permit the details of their handicraft to hide the general principles of their profession, do we commend a perusal of this book.

L. S. PILCHER.

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# THE RESULTS OF DIVISION OR RESECTION IN THE NECK OF THE PNEUMOGASTRIC AND PHRENIC NERVES.[1]

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## Pneumogastric Nerve.

THAT Galen was acquainted with cases of injury to one or both the recurrent nerves after excision of goitrous tumors and the consequent aphonia may be evidenced by the following quotation:

> "Quum ergo ex cervice quidam strumas in profundo sitas excideret ac deinceps, ne secaret aliquod vas, membranas non specillo cæderet sed unguibus evelleret, imprudens ob ignorantiam simul recurrentes nervos distraxit; atque hoc facto puerulum liberavit ab strumis, sed mutum reddidit. Quidam alius in alio puero sectionem faciens ipsum similiter semi-mutum reddidit læso videlicet dumtaxat nervo."[2]

During the present century vague references have been made by a number of writers to cases under consideration,—as, for instance, by Swan,[3] where, as the result of some disease of the pneumogastric trunk, there were during the life of the patient dyspnœa, purring respiration, and polyphagia. In this case upon autopsy both vagi, particularly the left, were found to be affected. In another case, reported by Bignardi,[4] where polyphagia was the most striking feature, the vagus was found to be involved in a number of small neuromata, or, at least, tumors which at that time went by that name. It is, of course, evident that the symptoms due to pneumogastric lesion must vary largely, according to the exact height of the same,—that is, according to whether the main trunk or only some of its branches are involved. Wounds of the pneumogastric from stabs and bullets appear to have been very rare, which Stromeyer[1] ascribes to the protection of the nerve-sheath and mobility of the same. It is interesting that Fearn has reported a case where, as the result of a stab-wound by a knife, the vagus and the carotid were both injured. The patient lived eleven weeks, during which he suffered from dyspnœa and dysphagia with frequent vomiting.[2] Stromeyer saw one case of crushing of the left nerve, where the gunshot canal passed completely through the neck back of the carotids. In this case, from the instant of injury respiratory sounds were lacking in the left lung, and did not recur. Upon autopsy it was found that the nerve had been pressed back against the vertebral column, and its sheath contained a milk-like fluid.

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[1] Read before the American Surgical Association, May 30, 1895.

[2] Opera omnia, ed. Kühn, Lipsiæ, 1824, T. VIII; De locis affectis, Cap. VI, p. 55.

[3] Treatise of Diseases and Injuries of Nerves, London, 1834, p. 170.

[4] Revue Méd., 1831, T. II.

(Query: Could the thoracic duct have been injured?)

Blanke[3] observed a gunshot-wound of the vagus during the Franco-Prussian War, as the result of which, apparently, pneumonia carried off the patient. Demme[4] has reported three cases of injury to the vagus. The first he observed in Milan, and presented at first slow, deep, snoring respiration with laryngismus and alteration of the voice, and reduced respiratory murmur on the injured side; later, severe asthma and collapse with frequent pulse. Similar symptoms were present in both of the other instances. Two of these patients recovered, the third dying during the second week. In this latter case, autopsy revealed a purulent infiltration of the vessels and nerves on the injured side and a hypostatic pneumonia.

In a thesis published by Deibel in 1881,[5] he has collected seventeen cases by various reporters of injuries to the vagus during operation. Widmer[1] has summarized these and added two more, both occurring in the practice of Kappeler in Münsterling.

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[1] Maximen, Second Edition, p. 116.

[2] Provincial Medical and Surgical Journal, November 7, 1848.

[3] Dissertation, Göttingen, 1871.

[4] Allgemeine Chirurgie der Kriegswunden, 1861, Band XI, p. 83.

[5] Ueber die Traumatische Vagus Paralyse, München.

It is certainly worthy of note that in most of the reported cases there were no symptoms directly attaching to the division of the vagus. Reports of disturbance, either of respiration or circulation, are relatively very infrequent. Considering now the particular influence of this nerve upon the various organs which it supplies, we may profitably study for a few moments the main results of its division.

So far as the larynx is concerned, it, of course, will make a difference whether the trunk be divided above the separation of the superior laryngeal nerve or below; again, whether the recurrent nerve be divided. The majority of reported cases seem to concern those in which, with the tumor situated on the side of the neck, the main trunk could be divided below the separation of at least the superior laryngeal. This superior laryngeal is given off at the lower end of the gangliform plexus, about a quarter of an inch beneath the jugular foramen, and, leaving the main trunk, passes between the internal carotid and the pharynx to the larynx, and is so far separated from the vagus itself that even in extensive extirpations it is seldom injured. It is to be regretted that in most of the reported cases accurate laryngoscopic examinations, as well as accurate data concerning the condition of the voice are lacking; and there are not statistics enough on which to base any very accurate statements. So far as I know, not one of these cases really lost the voice, and some of them were scarcely more than temporarily hoarse.

As more than one neurologist and physiologist has remarked, there is reason to wish for an entire and painstaking review of the subject of the innervation of the oropharyngeal and laryngeal muscles, since the nerve-supply to the epiglottis does not seem yet to be definitely settled. Leaving this question, however, to the anatomist, it is of surgical interest to know that in scarcely any of the reported cases has there been such disturbance of deglutition as to make it appear that the muscles of the epiglottis have been paralyzed. All of which, then, would look as though its muscles were supplied from the superior laryngeal source. It was said in one of Kappeler's cases that for a short time after the operation there seemed to be spasmodic contracture of the epiglottic muscles, which, however, passed away.

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[1] Deutsche Zeitschrift für Chirurgie, Band XXXVI, 1893.

R. Wagner made a number of experiments upon animals to elucidate the functions of the laryngeal nerves. He divided the recurrent, for instance, and found in every instance a median position of the vocal cord on that side. After double division, the cords assumed the median position for a few days, after which they took the cadaveric position, assuming it more slowly in older animals than in the young.[1]

The effects upon the lungs of pneumogastric division were studied at a time much prior to that when its laryngeal effects began to be observed. Valsalva[2] was the first who described the effect upon the lung of double division, although concerning the reasons for the same he was entirely in the dark. Since Valsalva, Morgagni, Longet, and others have concerned themselves with the same problems, until, finally, Traube[3] showed that along with paralysis of the adductors of the cords there was also paralysis of the œsophagus, with entrance of material which should pass down the œsophagus, and consequent pneumonia of a peculiar type. It has also been shown that the consequent lesions in the lung are very uncertain, and seem to be due in large measure to accident, not being constant results of double vagotomy. Frey came to these conclusions: (1) that the majority of cases survived operation; (2) that a certain proportion died after an indefinite time; and (3) that the cause of death was obscure, but that it certainly was not necessarily due to lesions of the lungs, nor to disturbances of nutrition. Some of these animals became emaciated, while their hair became coarse and fell out. In connection with these experimental results, the consequence of unilateral division of the vagus in man is not without interest. In Billroth's first case there were found in the lungs numerous circumscribed foci of red hepatization, which led Billroth to make this remark, "It is certainly of interest that the majority of these cases in mankind terminate fatally, although in dogs and animals it seems to have but little effect." Three years later, however, Billroth had another case of sarcoma extirpated from the neck with necessary resection of the vagus, which terminated successfully. Inasmuch, however, as in his first case it was necessary to make temporary resection of the lower jaw, and to remove a portion of the pharynx, as well as of the velum palati, as the result of which considerable blood ran into the lungs, it is perhaps easier to ascribe death to the combination of circumstances than to the mere division of the nerve. In Sawostitzky's case the patient manifested a double pneumonia, which is not sufficiently explained by anything contained in the case report at hand. In Labat's first case, also, we are told that there was considerable inflammation of the lung, although in the case report itself there is nothing to indicate upon what ground this was diagnosed,—in fact, all details are lacking. In Roux's fatal case, where the patient died on the sixth day of meningo-encephalitis, the lung complication does not seem to have appeared at first, and consequently was not primary. From a study of case reports, then, as well as from comparison of experimental results, it would seem of great importance to emphasize the fact that, although bronchopneumonia frequently results from bilateral division of the vagus, it is not necessarily due entirely to such nerve lesion, since in the lung corresponding to the injured nerve we find, not those conditions that we are often taught to expect,—namely, serous effusion, etc.,—but evidences of normal blood pressure and no œdema. In none of the other cases on record, aside from those above mentioned, is there significant proof of real paralysis of vaso-motors, nor of those vaso-motor fibres which the pneumogastric is supposed to contain.

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[1] Virchow's Archiv, Vol. CXX, p. 457, and Vol. CXXIV, p. 217.

[2] Epis. Anat., Vol. XIII, C. 30.

[3] Beiträge zur Pathologie und Physiologie, Berlin, 1871, Band I.

In a few only of the published cases has there been any immediate disturbance noted as following the nerve division, and most of those which were described could be explained upon some other cause, either from pressure of the tumor or some accident during operation. This is proven, for instance, by one of the cases in which the pleural cavity was opened, by which respiration was materially disturbed. All this disturbance, however, subsided immediately after tracheotomy,—all of which can be explained without reference to the vagus.

Cases of unilateral division of the phrenic, or of injury to the course of the phrenic,—as, for example, in fractures of the cervical vertebræ,—indicate that paralysis of the diaphragm, or at least of one-half of it, puts the patient in immediate danger of life, and also compels the other accessory inspiratory muscles to do an enormous amount of compensatory work. In Kocher's second case there occurred on the second day after the operation, without recognizable disturbance in the lungs, a severe dyspnœa, which was ascribed to a serious secondary hæmorrhage. A curious phenomenon was noted in Roux's case: whenever the fingers were pressed deeply into the wound, violent coughing ensued, which would make it appear that some sensory nerves or unduly sensitive nerve-fibres had been exposed. Comparing the information that may be gathered from all sources, surgical and experimental, we may say that with the exception of more or less vocal paralysis or hoarseness there is no definite disturbance of the respiratory apparatus which can be ascribed with any certainty to injury to the pneumogastric, nor which we have any definite reason to fear.

Concerning the influence of the vagus upon the rhythmical contractions of the heart, it would appear, from the studies of Schiff and Moleschott, that there run within this nerve certain fibres having an inhibitory influence upon the cardiac ganglia. Eichhorst[1] has shown by numerous experiments upon birds that after double division of the vagus an acute fatty degeneration of the heart is the result, which is directly due to the paralysis of certain trophic fibres contained within its trunk. In the smaller quadrupeds the condition is similar, but less marked. Consequently, he concluded that animals died after double vagotomy because of consecutive heart changes. It is of greater importance to remember that Eichhorst also found the same thing to occur after unilateral division, as well as that he corroborated Arloing and Tripier in holding that the right vagus had more to do with the innervation of the heart than the left. This may have been the condition of the heart in Sawostitzky's case, although he was inclined to ascribe it to other causes. Studying case histories, however, we come to the conclusion again that the equality and frequency of the pulse is practically uninfluenced by pneumogastric division, and that no really serious disturbance has ever been really due to such accident.

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[1] Die Troph. Beziehungen der Nervi Vagi zum Herz, Berlin, 1879.

The influence of the vagus upon the digestive apparatus is interesting in a physiological sense ; but that which more particularly interests us as surgeons is the possible interference with the act of swallowing, since the recurrent nerve sends motor fibres to the œsophagus and to the inferior constrictor of the pharynx. Studying the case histories, however, we again find that notable disturbances of deglutition have been extremely rare, and that division of the nerve has apparently exerted no lasting influence upon, nor disturbance of, this important function. One of Kappeler's cases complained during the first two days of pain upon swallowing ; but this was probably in no sense connected with the vagotomy, since almost any patient who has sustained a severe operation upon the neck will make the same complaint. Finally, the influence of this nerve division upon the general economy may be briefly studied. Frey and others have stated that certain animals—rabbits, for example—died after unilateral vagotomy without the occurrence of definite lesions in any single organ. How much this may have to do with surgery is an open question.

Schou[1] has advised that when one discovers that he has injured the vagus or recurrent nerve he should make immediate tracheotomy, and then should tampon the trachea above the opening, in order that he may with certainty prevent the aspiration pneumonia, to which, rather than to division of the nerve, death may be due. The aspiration of irritating material from the mouth or pharynx is more likely to occur in patients who are semiconscious or who are in collapse than in those who are quite in possession of their usual senses. While this difference is worth remembering, it certainly is not necessary to always carry it out, since there is, perhaps, as much danger of septic disturbance from the tracheal wound itself as from the pharynx above. Widmer[1] has also raised the question whether, when we have to deal with extensive and malignant tumors of the neck, especially with those which are producing severe pressure symptoms, it would not be wise to substitute simple tracheotomy for more radical and severe measures. To be sure, to do this will be to acknowledge the helplessness of the surgeon, but will probably tend to the prolongation of the life of patients. Thus, Braun has reported seventeen tracheotomies in malignant strumas. But, unfortunately for Widmer's suggestion, even in these cases dyspnœa was not necessarily relieved, and only one of these patients lived so long as twelve days; and in this instance dyspnœa was extreme, and death occurred from suffocation.

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[1] Om Behandlingen af de Traum. Vaguslaesionen med Permanent Tamponade af Trach., Nord med. Arch., Band XVIII, No. 5, 1886.

It has been stated by Flint that after section of the pneumogastric digitalis has been found to have no effect upon the heart's action; while H. C. Wood has observed that under like conditions cathartics would not produce purgation. These statements have been made the subject of experiment by C. S. Jones,[2] and have been in the main corroborated by him. It was also stated by Flint that after section of both pneumogastrics death always resulted in from one to six days unless the cord ends reunited. The experiments of Jones and of numerous other observers have disproved this statement. Furthermore, that after the lapse of a number of days the suspended normal functions were gradually restored, and that digestion of food, nevertheless, occurred; while heart-beats have been known to come down from 210 to 120.

I am indebted to my friend, Professor Pohlman, for the statement that after division of the pneumogastric in dogs he has found round ulcers in the stomach with such regularity that he now expects them as the usual effect of such nerve section. I am not aware that anything of this kind has been noted clinically, and do not know exactly how to explain it, save possibly upon the hypothesis that the pneumogastric has more to do with the trophic changes of the stomach in the dog than in the human being.

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[1] Loc. cit.

[2] Medical Press of Western New York, 1888, Vol. III, p. 184.

Guttman[1] has particularly called attention to the frequency with which large tumors of the cervical lymphatics, the thyroid, the peribronchial lymphatics, aneurisms, etc., may produce a compression paralysis of the pneumogastric, by pressure either in the neck or within the thorax. This paralysis is very rarely bilateral, and when it is so involves usually only the inferior laryngeal nerves. Longet[2] collected a considerable number of cases of this general character from literature; and these cases were added to by Montault, Hankel, Ley, Kyll, and others. In a case reported by Gaubric and referred to by Longet, both inferior laryngeal nerves were included within a tumor springing from the thyroid. Thereby a peculiar character was given to the respiration. Such incidents have become more and more frequent as men have learned better to watch for them or to appreciate them. Within my own experience I have repeatedly seen patients suffering, and eventually dying, from complications evidently connected with implication of some portion of the pneumogastric in primary or recurring malignant tumors. A number of times I have seen evidences, apparently unmistakable, of pressure by infected bronchial lymph nodes, which are the more painful to observe because of the utter helplessness of the condition. Heine[3] reported a most typical instance demonstrating the inhibitory action of the pneumogastric. His patient suffered from paroxysms of indescribable anxiety and apprehension, much like those produced in angina pectoris, in which the heart pulsations would drop to one-fourth or one-sixth of their regular number,

[1] Virchow's Archiv, Vol. LXXIX, p. 51, et seq.

[2] Anat. et Phys. du Syst. Nerv., Vol. II, 1849.

[3] Müller's Archiv für Physiologie, 1841, p. 236.

to resume the usual pulse-rate on the expiration of the attack. Rokitansky made the section, and found the right phrenic nerve and cardiac branches, as well as the ascending cardiac branches of the left pneumogastric, involved in a small tumor. Blandin is stated by Longet to have had to do with an analogous case in several respects, in which the vagus was found to be the site of a very small tumor, arising from its own tissue, apparently primary in the neurilemma, and leading to atrophy of the trunk below the tumor.

Two or three other conditions have been noted by Guttman[1] which, perhaps, are worth a reference here. For instance, Bignardi found on the post-mortem examination of a woman who had died of some lung disturbance, and whose last weeks of life were characterized by a most ravenous appetite, that both pneumogastrics were involved in a number of small reddish neuromata, which had about the size of the ganglia on the posterior roots of the spinal nerves.

Swan[2] reported also the case of a patient who, in spite of apparent healthy condition of the lungs, suffered intensely from dyspnœa, and who had also a ravenous appetite, which he was apparently never able to completely satisfy. When he vomited, it was found that the stomach would reject food apparently unchanged, although it might have remained there several hours. In his case both pneumogastrics were found atrophied, especially the left one.

Furthermore, Longet refers to an observation of Johnson's, who has reported a case of softening of the medulla and compression of the nucleus of origin of the left vagus by an aneurismal dilatation of the left vertebral artery. In this instance the patient lost all sense of hunger and thirst. From which contradictory instances, above noted, it would appear impossible to draw exact conclusions as to the precise influence of the vagus upon the sensations of hunger, thirst, and repletion.

In certain text-books and treatises I have found certain paragraphs bearing on this subject which are, perhaps, worthy of reproduction, although they are not given in any particular order, nor do they have particular bearing on any one case. They are quoted here because I have been anxious to get together an epitome of all the literature on the subject.

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[1] Virchow's Archiv, Vol. LXIX, p. 64.

[2] Treatise on Diseases and Injuries of Nerves, London, 1834, p. 170.

Chelius[1] quotes a case reported by Hennen, of an officer who was wounded in the neck about an inch above the origin of the sterno-cleido-mastoideus, the ball passing into the thorax and leaving no trace of its route. He lost an enormous quantity of blood, his left arm hung nearly lifeless, pulse 120, and the following day he spit up frothy blood copiously, and had severe and almost constant retching with spasm of the throat and hiccough. On the third day the dyspnœa was almost suffocating, and nerve symptoms were also serious. On the fourth day his voice was lost until the sixth. On the thirtieth day, after severe spasmodic bilious vomiting, speech was again temporarily affected. Some six weeks later he went home, where he continued to improve. This may have been an injury to the pneumogastric or some of its branches.

Chelius has also noted the fact that injuries of the pneumogastric cause loss of voice, spasmodic symptoms, and sometimes death. Injury of the recurrent nerve also causes loss of voice, which may occur subsequently. He states that injury of the laryngeal nerve is fatal from arrest of breathing, and that this is the particular branch whose section so quickly produces death in animals.[2]

Luecke[3] has alluded to the fact that certain fibres of the large nerves may be involved in a tumor without compromising the activity of the entire nerve. The fact also of the slow growth of the tumor seems to have an important influence, since the nerve apparently becomes accustomed to this encroachment upon its integrity.

Billroth[4] makes this statement: "All cases of unilateral division of the vagus in the human being appear to have terminated fatally, although these operations in dogs and larger animals have produced but little disturbance and are never fatal."

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[1] System of Surgery, translated by South, Vol. I, p. 480.

[2] See Pye, Aufsätze und Beobachtungen aus der gerichtlichen Arzneiwissenschaft, Saml. VII, p. 185.

[3] Geschwülste, Pitha und Billroth, Handbuch, p. 36.

[4] Archiv für klinische Chirurgie, Vol. II, p. 655.

Deibel[1] calls attention to the property possessed by nerves and vessels of resisting the encroachments of tumors, just as Langenbeck[2] had much earlier pointed out. This is fortunate, since the vagus and phrenic nerves remain apparently uncompromised by a degree of pressure which *a priori* it would hardly seem as if they could resist. They permit, moreover, considerable displacement without interference of function. Billroth[3] has shown that of all the important structures in the neck the jugular vein is most easily displaced, and is usually found at the greatest distance removed from its proper position; also that its wall is more often found adherent to the tumor surface than is that of the artery or the substance of the nerve.

Fischer[4] says, "Isolated injuries of the cervical nerves one would hold for scarcely possible, were it not for the character and composition of certain gunshot wounds of the neck. Altogether, they are not frequent, and their symptoms are never so clearly developed that a precise diagnosis can be made. Death is not the invariable result. Balls have wounded the pneumogastric more than once. Stromeyer has reported a case where the nerve-trunk behind the carotid was injured by a ball which crushed a cervical vertebra, while the right nerve was only slightly involved; in consequence of which respiratory murmur was lacking on the left side. In three instances the injury has been suspected because of slow, deep, snoring, difficult respiration, laryngismus, hoarse voice or loss of voice, lessened respiratory murmur, dyspnœa, and fainting attacks. In two of these instances the patients recovered, while one died in the second week of pneumonia and purulent infiltration. These are reported by Demme. Schueller holds that by pressure upon the nerve-trunk of the cicatricial tissue filling such a gunshot canal, a slowing of the heart's action may be produced. Fearn has seen difficulty in swallowing and fainting attacks, followed by death in three weeks, as the result of a division of the pneumogastric and the carotid; while at the end of the upper extremity of the nerve which was divided was found a neuroma."

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[1] Deibel's Thesis.

[2] Beiträgen z. chir. Path. der Vennen, Archiv für klinische Chirurgie, Vol. 1, p. 62.

[3] Chir. Klin., Wien, 1870, p. 76, Hals.

[4] Deut. Chir., Lieferung 34, Krankheiten des Halses.

Gross:[1] "The division of the phrenic nerves is nearly instantaneously mortal, and the same is true of division of the pneumogastric nerves, although this has occasionally been denied. If only one of the pneumogastric nerves is left, the patient may survive, . . . or he may perish from the effects of congestion and inflammation of the lungs."

Conner:[2] "To injury of the pneumogastric was attributed by Larrey the intense thirst which is at times experienced by the subjects of œsophageal wounds.

"Occasionally several of the important nerves are simultaneously injured, as the case reported by Stromeyer, in which the phrenic, pneumogastric, middle ganglion of the sympathetic, and the descendens noni were wounded, together with the larynx and pharynx."

According to Dupuy, animals may live for some time after division of both pneumogastrics, providing the trachea be opened below the larynx; while if the opening be not made, the animal dies on account of paralysis of the muscles controlling the glottis.[3]

## THE PHRENIC NERVE.

The phrenic has already been incidentally mentioned in several of the cases above epitomized, and in some of the general statements already made in this paper. Consequently it calls for but little further and separate mention.

Fischer[4] states that "when this nerve was included in the ligature of the subclavian outside of the scalenus there set in immediately after the operation a continuous violent cough, which lasted until the patient's death, on the fifteenth day. The nerve itself was found uninjured, but its neurilemma was markedly inflamed or congested. This was the condition under observation in a case reported by Bransby Cooper, where the mistake was made of including the nerve within the ligature.

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[1] System of Surgery, Vol. II, Fifth Edition, 1872, p. 423.

[2] Gunshot Wounds, International Encyclopædia of Surgery, Vol. II, p. 183.

[3] Jour. de Méd., par Le Roux, etc., Vol. XXXVII, p. 351; Meckel, Handbuch der gerichtlichen Med., Halle, 1821, p. 172.

[4] Loc. cit., p. 123.

Agnew[1] states that he has in his possession a preparation in which the entire phrenic nerve passes over the third part of the subclavian artery, so that it might be damaged at a point where it would scarcely be looked for. The details in Bransby Cooper's case are not explicit enough to show whether this anomaly obtained in that instance.

Ericsen[2] says, "The division, however, of the respiratory nerves on one side only . . . would, in all probability, be fatal in man by interfering with the proper performance of the respiratory act. In a case with which I am acquainted, where the phrenic nerve was divided during ligation of the subclavian artery, death resulted in a few days from congestion of the lungs."

Demme has observed three cases of injury to these nerves. It is stated that two recovered, while the third died of pneumonia.

Riedel[3] has published a case of resection of the left nerve during extirpation of a tumor. No symptoms were discoverable at the time. Patient died on the fourteenth day, and on autopsy purulent bronchitis on this side was noted.

Hutin[4] wounded the phrenic in making ligature of the subclavian artery.

Hueter-Lossen[5] say that paralysis of half of the diaphragm puts life in immediate danger. This is evident, not only from observation of injuries to the phrenic itself, which are rare, but from injuries to the roots of the nerves in the spinal cord, which determine practically always a fatal termination. These latter may be produced by injuries from the fourth cervical vertebra down, or by degenerative processes spreading from below upward. They are always indicated by paralysis of this principal muscle of respiration, the accessory muscles having been already more or less paralyzed, probably completely. Diaphragmatic paralysis is always easy to determine, since by it alone is inspiration prevented under ordinary circumstances.

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[1] Treatise on Surgery, Vol. I, p. 321.

[2] Treatise on Surgery, Eighth Edition, 1884, Vol. I, p. 785.

[3] Berliner klinische Wochenschrift, 1883, p. 543.

[4] Quoted by Lafoure in Dict. Encyl. de Sci. Méd., Third Series, Vol. x, p. 707, article Sous Clavière.

[5] Chirurgie, Vol. II.

Finally, the suggestion made by Wyeth[1] that when the pneumogastric, hypoglossal, or other important nerves have been divided, the ends should be brought together by a delicate silk suture, may possibly be put into practice with the same success attending nerve suture in other trunks. The suggestion, at least, is a valuable one, and is given here for what it may be worth. (*Vide* Case 47, Table II.)

The following quotations may also be introduced here, having more or less relevancy to matters already spoken of:

"International Encyclopedia of Surgery," Vol. v. p. 107; Nancrede: "Aphonia, dysphagia, dyspnœa, with contraction of the muscles accessory to respiration, and more or less paralysis of the pharynx, œsophagus, and stomach were the main symptoms presented by a patient who recovered from a brain wound in which the glossal, pharyngeal, pneumogastric, hypoglossal, spinal accessory, and suboccipital nerves were divided by the thrust of a lance."

Boinet[2] reported that he in one case was obliged to carefully separate the vagus from the carotid for the purpose of ligating the latter. He noted that each time the nerve was disturbed vomiting set in, without, however, any disturbance in respiration.

"Heath's Dictionary of Practical Surgery,"—"Gunshot Wounds," subheading, "Gunshot Injury of Nerves." American Edition, 1886, p. 642.—"The pneumogastric has been sometimes divided in the neck, generally with an immediately fatal result and wounding of the adjacent vessels. Otherwise, the respiration becomes slow and labored, the voice is lost, the pupil on the injured side contracted, and pneumonia supervenes."

Duplay and Reclus (*Traité de Chirurgie*, Vol. v; Walther,

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[1] Wyeth's Text-Book, 1887, p. 444.

[2] Gazette des Hôpitaux, No. 102, p. 413.

p. 675): Injury to the pneumogastric may be made more probable by abnormal situation in front of the carotid, an anomaly alluded to by Le Dentu,[1] and actually encountered by Janelle,[2] during the course of a thyroidectomy. Walther emphasizes the fact that sudden disturbance from injury or division of the nerve is less likely to occur if it has been for some time accustomed to pressure by tumor or by some other lesion.

Finally, the following arrangement of possible results of lesions of the pneumogastric may be reproduced from Giordano:

The Pneumogastric may be involved Primarily in:—

- Diphtheritic neuritis.
- Mycotic neuritis (kakké).
- Post-typhoid, etc., neuritis.
- Toxic paralysis (as after use of iodine for goitre, etc.).
- Tabetic paralysis.
- Bulbar hæmorrhages, tumors, etc.

Secondarily in:

- Phlegmons of neck.
- Pericarditis.
- Periaortitis.
- Tumors,—bones of base of skull, etc.
- Tumors,—side of neck.
- Tumors,—thyroidal.
- Tumors,—mediastinal, lungs, etc.
- Aneurisms, aortic and innominate.
- Pleuritic exudates,—apical.
- Pericardial exudates.
- Peritracheal lymphatic tumors.

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[1] Bulletin de la Société de Chirurgie, 1860, May, p. 280.

[2] International Encyclopedia of Surgery, Vol. V.

TABLE I.—ACCIDENTAL INJURIES TO THE PNEUMOGASTRIC.

| No. | Reporter. | Result. | Remarks. |
|---|---|---|---|
| 1 | Fearn. | D. | Stab-wound; carotid divided also; vomiting; glottic œdema; aphonia; death, eleventh week. (Provinc. Med. and Surg. Jour., 1847, Sept. 8.) |
| 2 | Stromeyer. | D. | Bullet-wound; right vagus blown to pieces; left vagus crushed; death after third week. (Pitha-Billroth, III, I, 4.) |
| 3 | Demme. | R. | Bullet-wound; recovery. |
| 4 | " | R. | Bullet-wound; recovery. |
| 5 | " | D. | Bullet-wound; death in two weeks; pneumonitis. (Pitha-Billroth, l. c.) |
| 6 | Verga. | D. | Bullet-wound; death in three weeks. (Tamassia, Della azione del Pneumogastrico, etc.; Riv. Sperimentale di Freniatria e di Med. Legali, 3, p. 229, *et seq.*) |
| 7 | Hennen. | ? | Bullet-wound; aphonia; result not given. (Fischer, Deutsche Chir., Lief. 34, p. 17, S. 125.) |
| 8 | Beck and Stromeyer. | D. | Bullet-wound; injury also to phrenic, cervical, ganglion, and hypoglossal; respiration slow; death fifth day from laryngismus. (Fischer, p. 125.) |
| 9 | Peyrot. | ? | Bullet-wound; no details. (Walther, in Duplay and Reclus, Vol. V.) |
| 10 | Montauld. | D. | Trauma; fracture of left cornu of hyoid with pressure on vagus; dysphonia; dysphagia; dyspnœa; death in twenty-four hours. (Eulenberg, Art. Erkrank. d. Nervus Vagus, Real Encyclopædie, Band XX.) |
| 11 | . . . . . . . . . | D. | Suicidal cut-throat attempt in woman of thirty-six years. Right pneumogastric divided; no marked symptoms; no post-mortem appearances. (Brit. Med. Jour., 1856, June 13.) |
| 12 | Bowlby. | D. | Fracture of base of skull, with laceration of eighth pair on left side. Post mortem showed this condition, and that left lung was in condition of solid œdema and airless. (L. c., p. 115.) |
| 13 | Burggrave. | D. | Patient run over by wagon. Usual case, traumatic compression of vagus and sympathetic; death soon after. Autopsy showed an extravasation of blood completely surrounding these two nerves. (Union Méd., 1852, p. 531.) |
| 14 | Savory. | D. | Case of abscess. Large portion of pneumogastric nerve also destroyed in its course through the cavity. The two ends of nerve were found free in upper and lower part, a portion being wanting; no very obvious effect of this destruction. During last two or three days of life pulse very rapid, but might otherwise be well explained. After death left lung presented no characteristics that could be especially associated with the lesion of nerve. (Trans. Royal Med. and Chir. Soc., Vol. XLIV, p. 28.) |
| 15 | Riegel. | D. | Post mortem of man of fifty-three years. Chief symptom extreme rapidity of pulse,—164. Left vagus, just below recurrent branch, embedded and firmly incorporated in enlarged bronchial node. (Berliner klin. Wochen., 1875, August 2.) |

TABLE II.—INJURIES TO THE PNEUMOGASTRIC DURING OPERATIONS UPON THE NECK.

| No. | Reporter. | Result. | Remarks. |
|---|---|---|---|
| 1 | Labat. | R. | Female of twenty-eight years. Extirpation of cervical cancer; resection of common carotid, internal jugular, and right vagus; pulmonary paralysis on left side; recovery. (Testi, Broussai's Annales, 1834.) |
| 2 | Roux. | D. | Male, forty-five years. Same kind of case. Died on seventh day. (Prov. Med. and Surg. Jour., 1847, September 8.) |
| 3 | Roux. | D. | Cancer of neck; vagus tied with carotid, but subsequently liberated; death in one-half hour. (Tamassia, l. c.) |
| 4 | Billroth. | D. | Male, thirty-four years. Sarcoma of neck; common carotid tied and vagus resected; respiration slackened; dysphagia; death in three days; pulmonary œdema, etc. (Arch. f. klin. Chir., Vol. II.) |
| 5 | Billroth. | R. | Male, thirty years. Lymphoma of neck; resection of vagus and internal jugular; paralysis of vocal cord; recovery. (Chir. Klin., Zurich, 1860–67.) |
| 6 | McClellan. | R. | Two inches of the vagus exsected from enlarged parotid gland below angle of jaw; apparently not much inconvenience to respiratory or other functions. Left wound open several days to let other surgeons inspect, on account of being an unprecedented result. (Am. Edit. Velpeau's Operative Surg., Vol. II, p. 427.) |
| 7 | Robert. | R. | Male patient. Vagus included in ligature of carotid. Voice instantly became hoarse; fainted; recovered shortly; voice not regained for six months. (Gaz. des Hôpi., 1863, No. 102, p. 413.) |
| 8 | Chassaignac. | R. | In 1849, pneumogastric included in ligature of common carotid; respiration and deglutition not disturbed, but voice immediately extinguished. (Bowlby, Injuries and Diseases of the Nerves.) |
| 9 | Esmarch. | D. | Male, forty-five years. Sarcoma of parotid; common carotid and internal jugular injured with the vagus; death in six weeks. (Arch. f. klin. Chir., Vol. XX, p. 611.) |
| 10 | Esmarch. | D. | Male Recurring cancer; resection of three centimetres of involved vagus; death in one week; hæmorrhage and récidive. (Ibid.). |
| 11 | Sawostitzky. | D. | Male of eleven years. Lymphosarcoma; resection of common carotid, jugular, and vagus; death in ten hours. (Centralblt. f. Chir., 1880, No. 10.) |
| 12 | Sawostitzky. | D. | No details; death. (Ibid.) |
| 13 | Schönborn. | D. | Female, twenty-three years. Alveolar sarcoma; resection of carotid and vagus; death in thirty-six hours. (Deut. Zeit. f. Chir., Vol. XIII, p. 394.) |
| 14 | Lücke. | R. | Female of thirty years. Cancer of neck; resection of jugular and twelve centimetres of diseased vagus; recovery. (Centralblt. f. Chir., 1880, No. 36.) |

Table II.—Injuries to the Pneumogastric during Operations upon the Neck.—*Continued.*

| No. | Reporter. | Result. | Remarks. |
|---|---|---|---|
| 15 | Czerny. | R. | Male, forty-six years. Cancerous goitre; resection of jugular and three centimetres of vagus; recovery. (Deut. Zeit. f. Chir., Vol. XIV, p. 143.) |
| 16 | Bardeleben. | D. | Male, fifty-seven years. Cancer of neck; vagus included in ligation of carotid and jugular; death in two hours. (Deibel, l. c.) |
| 17 | Langenbeck. | D. | Female, forty-nine years. Cancerous goitre; ligature of carotid and jugular; pleural cavity opened; vagus resected; cyanosis, dyspnœa, and pulmonary œdema; death in eight hours. (Deibel, l. c.) |
| 18 | Riedel. | D. | Male of forty-nine years. Goitre; ligature of vessels; vagus divided; pulmonary œdema and putrid bronchitis; death on the fourteenth day. (Berl. klin. Woch., 1883, No. 23, p. 343.) |
| 19 | Robert. | R. | No details; vagus included in ligature of the carotid; sense of suffocation; recovery with aphonia. (Tamassia, l. c.) |
| 20 | Boinet. | R. | Injury to vagus during ligation of carotid; vomiting, (Eulenberg, l. c.) |
| 21 | Kappeler. | R. | Resection of vagus; aphonia; recovery. (Tamassia, l. c.) |
| 22 | Mackenzie. | R. | No details; recovery. (Tamassia, l. c.) |
| 23 | Jeannel. | D. | Male. Thyroidectomy; no details; death. (Internat. Encyc. of Surg.) |
| 24 | S. Cohen. | R. | Division of vagus; vocal paralysis; no details; recovery. (Rénault in Traité de Méd. de Charcot et Pouchard, Vol. IV, p. 1.) |
| 25 | Verneuil. | ? | Cancer of neck; no details; symptoms rather of injury to sympathetic; result. (Fischer, l. c.) |
| 26 | Michaux. | R. | Extirpation of lipoma. While tying its pedicle, vagus was caught; respiration ceased, to be resumed when nerve was released; recovery. (Koenig and Riedel, Deutsche Chir., Lief. 36, p. 109.) |
| 27 | Kohos. | R. | Cancer; division of vagus; recovery. (Eulenberg, l. c.) |
| 28 | Vogel. | R. | Similar case. (Ibid.) |
| 29 | Guida. | R. | Male of forty years. Sarcoma of neck; resection of carotid, jugular, vagus, and hypoglossal; no violent symptoms: recovery. (Riforma Med., 1892, Vol. IV, p. 466.) |
| 30 | Mugnaj. | R. | Sarcoma of neck. Disturbance of vagus during operation; pleural cavity opened; no symptoms; recovery. (Gaz. degli Ospitali, 1889, No. 99.) |
| 31 | Caselli. | D. | Similar cases but speedy death. (Atti del Third Cong. della Soc. Ital. di Chirurg.) |
| 32 | Caselli. | D. | Similar cases but speedy death. (Atti del Third Cong. della Soc. Ital. di Chirurg.) |
| 33 | Novaro. | D. | Male, fifty-three years. Cancer of bronchial remains; vagus exposed, and disturbed opposite pulley of digastric. Later, pulmonary œdema, necessitating tracheotomy; death the third day. (Giordano, l. c.) |

TABLE II.—INJURIES TO THE PNEUMOGASTRIC DURING OPERATIONS UPON THE NECK.—*Continued.*

| No. | Reporter. | Result. | Remarks. |
|---|---|---|---|
| 34 | Novaro. | R. | Male, fifty-six years. Sarcoma of accessory thyroid; resection of ten centimetres of vagus; no serious symptoms; recovery. (Giordano, l. c.) |
| 35 | Marchand. | D. | Angiosarcoma of carotid gland; ligature of carotid and jugular; death from bronchopneumonia. At autopsy found vagus and sympathetic had been removed with tumor. (Centralblt. f. allgem. Path. and Path. Anat., 1892, p. 906, Ref.) |
| 36 | Tansini. | R. | Female of twenty-four years. Tubercular disease; resection of vagus; jugular tied; no serious symptoms; recovery. (Latis and Fogliani, Rendiconto Cl. della Cl. Chirurg. di Modena, 1892, p. 41.) |
| 37 | Kappeler. | D. | Male of sixty-three years, 1878. Cancer of neck; resection of five centimetres of vagus; death in collapse on second day. (Giordano, l. c., p. 271.) |
| 38 | Kappeler. | D. | Male, sixty years, 1890. Cancer of neck; low resection of four centimetres of vagus; death from hæmorrhage and recurrence. |
| 39 | Kocher. | R. | 1883. Cancer in neck; resection of five centimetres of vagus. |
| 40 | Kocher. | D. | Cancerous goitre with paralysis of sympathetic and hypoglossal; resection of these with vagus; death in ten hours. |
| 41 | Kocher. | D. | Cancer of œsophagus and glands; resection of vagus, sympathetic, and part of cervical plexus; death on fourth day from hæmorrhage. |
| 42 | Rivington. | D. | Division of pneumogastric during ligation of internal carotid; no special symptoms; death from cerebral abscess. At autopsy no special lesions found. (Rep. to Roy. Med. and Chir. Soc., 1885.) |
| 43 | Czerny. | R. | Lymphosarcoma of left tonsil extending into pharynx and soft palate. Operation June, 1877. Division of digastric, stylo-hyoid, stylo-glossus. hypoglossal, glosso-pharyngeal, and lingual nerves; recovery. (Beit. z. operativen Chir., 1878, p. 65.) |
| 44 | Czerny. | R. | Recurring lymphosarcoma in cervical lymphatics after extirpation of larynx and wearing of artificial substitute. First operation, August, 1878; second, October, 1879, when veins were extensively divided and three centimetres of left pneumogastric excised. Also excision of portion of hypoglossal nerve; no disturbance of pulse nor respiration; death a month later, but from causes connected rather with the malignant disease than from the operation. (Berl. klin. Woch., 1882, No. 26, p. 27.) |
| 45 | Mynter. | R. | Melanotic sarcoma of left side of neck, involving parotid region and superior triangle of neck, also lateral region of neck down to clavicle. Operation May 27, 1890. Temporary ligature of common carotid, facilitating removal of tumor. Finally, necessary to exsect a portion of carotid, internal jugular, and pneumogastric, which were embedded in the mass for several inches. Wound partially sutured and packed. Left facial also divided. Death June 13 of cerebral anæmia. (Personal communication.) |

TABLE II.—INJURIES TO THE PNEUMOGASTRIC DURING OPERATIONS UPON THE NECK.—*Concluded.*

| No. | Reporter. | Result. | Remarks. |
|---|---|---|---|
| 46 | Harrington. | R. | Complete excision of portion of right nerve during operation for removal of extensive tumor from neck. (Case not yet reported.) |
| 47 | Bloodgood. | R. | Divided the pneumogastric by accident during operation on the neck, and, although there was no disturbance noted at the time, made immediate primary suture of the same. Patient recovered without perceptible effect. (Personal communication from Professor Halsted.) |
| 48 | Fenger. | R. | Case of division and exsection of the nerve during operations upon the neck. Will be reported in detail by him. Recovered. |
| 49 | Fenger. | R. | Case of division and exsection of the nerve during operations upon the neck. Will be reported in detail by him. Recovered. |
| 50 | Gross. | ? | One case, recalled by Dr. Connor, in which the nerve was divided during operation. Personal communication. |

Scanning the cases collected in Table I, we find that out of fifteen instances in which the pneumogastric was accidentally involved in malignant disease or merely in accidental injuries, eleven died and two recovered; while in two instances the result has not been reported. It is, of course, impossible to separate the causes of death so far that one may distinctly state whether death was due to lesion of the nerve-trunk itself or to coincident lesions of other important structures. The fact, however, remains that out of thirteen cases whose results are known, eleven died.

Of the fifty cases included under Table II, we are left in doubt in two instances; while of the remaining forty-eight, twenty-one died and twenty-seven recovered. All of which constitutes a favorable showing, which to the writer seems a sufficient contradiction for statements found in the older works. Here, too, in the fatal cases it is impossible to say that in any instance death was due to injury to the nerve; and there have been included under the deaths several cases where the fatal issue was so long postponed as to constitute valid doubt. Nevertheless, the preponderance of testimony is in favor of the comparative safety of attacking this nerve when involved in disease, and when too much other operating is not necessitated by the condition which has caused the operative attack.

The following list of references is given in addition to those already mentioned in the body of the paper:

*Giordano:* Contributo allo Studio delle Lesioni Chirurgiche del Pneumogastrico. (La Clinica Chirurgica, 1893, No. 6, Vol. I.)

*Widmer:* Ueber Einseitger Durchschneidung und Resection des Mensch. Vagus. (Deut. Zeit. f. Chir., Bd. XXXVI, Hefte 3 und 4, 1893; Med. Chir. Gaz, March 20, 1881, p. 130.)

*Schou, J.:* On Behandlingen af de Traumatiske Vaguslaesioner und Permanent Tamponade af Trachea. (Nord Med. Ark., Stockholm, 1886, No. 5, pp. 1–8.)

*Phillipeaux:* Compt. Rend. Soc. de Biol., 1885.

*Barnard:* Accidental Injuries to Nervous System. (New Eng. Med. Gaz., Boston, 1888, Vol. XXIII, p. 397.)

*Agnew:* Surgery (Vol. I, p. 319) quotes Dunham's 150 Cases of Neck Wounds with no Injury to Nerves in Question.

*Ranney:* Complete Anatomy of Nervous System, pp. 496–8, Effects of Nerve Section.

Cyclopædia of Anatomy and Physiology, Vol. III, p. 899, Experimental Section,—Old Observations.

Med. and Surg. Hist. of Crimea, p. 199, 382 Cases of Wounds of Neck.

St. Bartholomew Hosp. Reports, Vol. XVI, p. 100, Abnormal Distribution of Phrenic Nerve.

*Hofmokl:* Bericht der K. K. Krankenhaus, Rudolph Stiftung, Wien, 1889–90, p. 300. Stichwunde an der Linkenhalsseite, Verletzung der drei Hals Nerven.

*Robert:* Lesion del Nervico Frenico. (Rev. de Med. y Chir. Pract., Madrid, 1887, Vol. XX, p. 393.)

# THE TREATMENT OF OBSTRUCTION OF THE COMMON GALL-DUCT.

By THEODORE A. McGRAW, M.D.,

OF DETROIT.

WHILE operations on the gall-bladder have become very frequent during the past two or three years, the operations on the common gall-duct for the relief of jaundice caused by impacted gall-stones have been comparatively infrequent.

This is to be ascribed in part to the great and sudden popularity given to the operation of cholecystenterostomy, among American surgeons at least, by the invention of that unique and ingenious mechanical device, the Murphy button. There is something exceedingly attractive in a procedure by which, in a few minutes and with comparatively little danger, a patient may obtain relief for the time being, at least, from the discomfort and distress incident to obstructive jaundice.

This is certainly accomplished in skilful hands by the use of the Murphy button. The viscera to be united by its aid are comparatively superficial, and a small abdominal incision serves to expose them and to perform the work. The button is easily and quickly adjusted, the bile begins immediately to pass through the new channel, the jaundice disappears, the intolerable itching ceases, the fæces acquire their proper look and odor, and the patient feels himself almost at once relieved from a serious illness, and begins to consider himself a well man. It is, therefore, no wonder that the device has, so to speak, taken the surgical world by storm, and that surgeons have been eager to test the promising invention. In the report of Dr. Murphy, published on February 9, 1895, thirty-six cases of cholecystenterostomy were reported by various surgeons for non-malignant obstructive jaundice with only one death, a truly astounding success, if all cases have been reported, for an operation still new and on trial. In the light of such reports, one feels almost ashamed to proclaim himself a doubting Thomas, and yet there must be, for the discovery of truth, a few who criticise as well as many who applaud, and I venture to publicly state the reasons why I do not consider cholecystenterostomy a proper operation for those cases of jaundice in which the obstruction is caused by the presence of a stone in the common duct. The objections to the procedure begin at once to become manifest the moment that we ask ourselves what else ought to be done by a conscientious surgeon besides affording immediate relief to unpleasant symptoms, or we may approach the subject in a different way by asking what morbid conditions might remain after a successful cholecystenterostomy, to plague the patient and cause further disability. We will see in the first place that while the symptoms caused by the obstruction have been made to disappear, the stone which caused the obstruction is still in the common duct, irritating it by its presence, and now that the stream of bile has been diverted into a new channel without any possibility of being forced forward into the intestine. It remains a constant source of irritation which spreads usually, in time, beyond the walls of the duct, and causes peritoneal inflammations and adhesions. It may even produce abscess and suppuration, with all their dangerous consequences. How little of the local irritation produced by the presence of gall-stones is due to the mere obstruction of the bile stream is seen in the case of those stones which lodge in the cystic duct. Where this occurs there is no pressure whatever exerted at the point of obstruction, for the simple reason that the bile has a free channel for escape through the common duct into the intestine; and yet these stones in the cystic duct which cause no jaundice, no itching, no damming up of the bile stream, nevertheless produce in very many instances the most acute and constantly recurring agony. Now, while the common duct is larger than the cystic, and while it requires a larger calculus to fill its lumen, when obstruction does occur in its territory, it may cause no less disturbance and danger. Here then is the first serious objection to the operation with the Murphy button. While it relieves, it does not cure. It leaves behind a focus of irritation which may develop into a condition of danger, and, however important it is to relieve pain, our surgery should aim at something more. We should try not only to relieve but to cure.

But there are still graver objections to be urged against this procedure. We may be content to use an imperfect method in order to bring comfort even though it does not meet all indications, provided that it does no harm. It is important to ask of every new operation in what way the organism is injured by its use? What are the conditions left after the use of the Murphy button or any other operation for the establishment of a fistula between the gall-bladder and the gut? There is evidently in this operation a firm adhesion established between the gall-bladder and bowel. This must inevitably produce at times great traction on one or the other of these organs, and interfere with their movement, and with the performance of their proper functions. In fact, the adhesions produced by gall-stones are often more serious and cause more disturbance than the passage of the gall-stones themselves. It is not uncommon for surgeons, operating for bilious colic, to find the traces of old gall-stones in inflammations around the gall-bladder, and gall-ducts after the gall-stones have entirely passed away. Indeed, the gall-stones may in their passage cause no pain whatever, and yet leave behind adhesions which become productive of great distress. There is no more instructive paper in the last year's contributions than the one by Riedel, in which he describes the numerous cases upon which he had operated in which no gall-stones whatever were found, but in which all sorts of trouble were caused simply by adhesions. In some patients the trouble took the form of severe and dreadful colicky pains, and in others of flatulence and discomfort. Others still had been treated for years and dosed with all manner of drugs for a chronic dyspepsia which finally yielded to the severance of adhesions by the surgeon's knife. I have had during the last year a patient under my care whose case will bear reporting in this connection as illustrating this point.

Augusta, a German girl, aged eighteen years, had for several years suffered from terrible attacks of colicky pain, which, coming at irregular intervals, would last sometimes for two or three days. In these attacks nothing would give her relief but large doses of morphine frequently repeated. Dr. R. A. Newman was called to attend her, and referred her to me with the diagnosis of cholelithiasis. I operated on her in July, 1894, and removed four gall-stones from the gall-bladder. As she had never been jaundiced and showed no signs of obstruction of the common duct, and as the bile poured out copiously through the resulting fistula, I concluded that I had reached the seat of her trouble. Scarcely, however, had she recovered from the operation when her attacks began again, and, as they continued in spite of all remedies, on September 4, 1894, I opened the abdomen again to search for other gall-stones in the ducts. The operation proved unsuccessful. No gall-stones could be found and the paroxysms of agony recurred oftener and lasted longer than before. Finally, on April 10, 1895, I made a large incision in the median line and thoroughly explored the stomach and bowels. I found the stomach adherent to the diaphragm throughout nearly its whole upper surface. I broke up all the adhesions and made it freely movable. The omentum was also widely adherent. I loosed it from its bowels and spread it carefully over the viscera. Thus far the patient, who has just left the hospital, has remained free from her old disorder.

The deductions to be drawn from such a case are self-evident. The pathological sequences were as follows: (1) A catarrhal trouble of the gall-ducts and gall-bladder; (2) the formation of gall-stones in the inflamed gall-bladder; (3) the passage of gall-stones through the ducts and out through the intestines; (4) inflammations extending from the gall-bladder and gall-ducts to the neighboring peritoneum, and, finally, the formation of permanent adhesions which bound the stomach, interfered with its normal movements and caused paroxysms of pain. The four stones in the gall-bladder represented probably a greater number which had been discharged without making the patient aware of their presence. The histories recorded by Lauenstein, Riedel, and Kehr demonstrate plainly that permanent adhesions are a fruitful source of misery. It is bad surgery, therefore, to deliberately produce such adhesions between viscera normally mobile, as long as any other way lies open to the surgeon. This, then, is my second objection to the operation of cholecystenterostomy, that it produces permanent and unyielding adhesions between the bowel and gall-bladder, which may cause frequent pain, flatulence, and distress during the processes of digestion, and finally render the patient liable to attacks of obstruction of the bowel by the bending or twisting of the bowel, if the jejunum, at the point of attachment.

A case of Kehr's is very instructive in this connection as showing how little relief may be given in these cases by the establishment of an orifice of communication between the gall-bladder and bowel. Operating on a patient for severe and intractable distress in the region of the gall-bladder, he cut what he thought was a simple adhesion between the gall-bladder and duodenum, but found that he had divided tissues bounding an orifice of communication between the two viscera. He sewed up the duodenum, removed the gall-bladder, incised the common duct, and removed from it two gall-stones. He subsequently operated again and removed from the choledochus other stones which had either been overlooked or had formed again. Here, then, was a case in which nature performed a cholecystenterostomy, and produced the very same conditions which surgeons seek to bring about by the Murphy button, without relieving the pain caused by the trouble.

Now, here I wish to call attention to a condition which must certainly arise in many cases after the operation of cholecystenterostomy. After this operation the stream of bile is diverted through the cystic duct and gall-bladder into the bowel. The gall-bladder takes on itself the function of the common duct. The profession seems to have overlooked the other fact that the common duct becomes to all intents and purposes an abnormal gall-bladder, for, remaining patulous at its upper end, it receives a certain amount of bile which stagnates in its dilated canal. It must not be forgotten that in these cases of obstruction the common duct often becomes enormously enlarged. In one I recently operated on I could put my thumb into the cavity occupied by the calculus. The bile then collects under circumstances which favor its crystallization. The new gall-bladder already contains one or more stones and is already irritated and inflamed. It may contain pus, but almost certainly contains mucus. Here, then, we have the beginning of a morbid condition of which no man can foresee the end. There is no reason why in the course of time the obstructed duct may not become full to overflow with the numberless gall-stones, which could not fail in this receptacle to cause fully as much disturbance as in the gall-bladder itself. Added to these most valid objections to the operation there is still another. We do not yet know how long the artificial fistula will remain open and permit the free flow of bile. The tendency of such orifices is to gradually contract and close, and what would be the condition of the patient when he ceased to feel the relief given by the operation and began again to have the old troubles in addition to those caused by the operation itself.

The history of the cases operated on by cholecystenterostomy is not yet complete. The immediate relief of symptoms has blinded the surgeon to the ultimate consequences of his work. I believe that the after-histories of many of these operations will be lamentable, and that these same patients will, many of them, in time, come back upon the surgeon's hands with aggravated troubles.

For these reasons I feel strongly opposed to the operation of cholecystenterostomy for jaundice caused by calculi in the common ducts. It is a make-shift operation, easy of performance and rapid in giving relief from symptoms, which will probably retain for considerable time its popularity with the more timid surgeons. It belongs, however, to the period of development in the surgery of the gall-ducts, and cannot possibly long retain the place which it at present holds.

There is only one rational procedure in case of obstruction of the common duct by gall-stones, and that is the removal of the stones. It is true that in many cases nature accomplishes this by forcing the stones through the duct into the duodenum, and cases are not uncommon in which this occurs and the stones appear in the evacuations. The knowledge of this fact, together with the difficulty in diagnosticating the cases from catarrhal and other forms of jaundice, causes many physicians to defer surgical treatment until a late stage of the disorder. The dangers incident to the disease are forgotten, the dangers of the operation are unconsciously exaggerated. An obstructive jaundice is always a dangerous condition. Indeed, the presence of gall-stones, even when the common duct is free, brings with it tribulation and trouble enough to warrant radical means for their relief. In the vast majority of cases there would be a probable gain to the patient if early in the trouble, when symptoms of gall-stones occur with or without jaundice, or when jaundice makes its appearance from doubtful causes, an exploratory operation were made, the exact diagnosis determined, and the necessary measures taken for relief. If we exclude the jaundice which accompanies acute fevers and septic conditions, there are few varieties in which an exploratory operation would not be of service. It must be remembered that the beginning of gall-stones is a catarrhal inflammation. The gall-bladder becomes infected from a catarrh which creeps up the ducts from the bowel. The mucus formed and deposited makes the nucleus on which the bile deposits its crystals. The most severe symptoms, those of colicky pain and intolerable soreness, are due not always to the presence of stones, but often to the inflammation of the gall-bladder and ducts. Now, the early incision and drainage of the gall-bladder enables the morbid secretions to find an exit. The inflammation rapidly subsides, and the case is quickly cured. The absence of gall-stones would bring no discredit on the surgeon, for his operation would act curatively on a condition which left to itself might produce danger, and certainly would produce serious illness and discomfort. If, on the other hand, gall-stones were present, their removal would take place with less pain, and I will even assert less danger, than if left to find a dubious and painful path into the intestine through the cystic and common ducts.

In favorable cases, which means those which are operated on early, before adhesions have formed to obscure the way and render dissection difficult, operations even on the gall-duct are not attended by very great danger. In old cases where the surgeon finds himself entangled in a morbid mass to which he has no clue, where stomach, omentum, gall-bladder, and small intestines are inextricably mixed and bound together, where the patient has lost his vital force by a long struggle with disease, it may become a very difficult, tedious, and dangerous matter to work one's way to the morbid focus and extract the calculus which has caused the mischief. In such cases, even the most experienced surgeon might be tempted to take the shortest way out of the trouble and perform a cholecystenterostomy. This would, however, be a great mistake. If a patient is so exhausted by long-continued jaundice as to make a prolonged operation inadvisable, the surgeon had better establish a biliary fistula through the abdominal wall. It gives the same relief as the operation of cholecystenterostomy, without injuring the intestine or establishing new adhesions within the abdomen. The discharge of bile onto the external surface of the abdomen is indeed not pleasant; but, on the other hand, the patient is not deluded with the vain hope that he is now about to get well, when, in fact, the worst part of the trouble is still in existence. A patient with an external biliary fistula recognizes the fact that he is not yet well, one whose fistula is internal awakes from a false confidence to the knowledge that he is still ill and in need of surgical assistance. How comfortable a patient may be with obstruction of the common duct and an external fistula of the gall-bladder is shown in a patient of Dr. F. L. Newman, upon whom I operated on July 24, 1894.

She was jaundiced and suffering from inflammation of the gall-bladder. I operated and found the gall-bladder everywhere adherent to the abdominal wall. I opened it and extracted 153 gall-stones. She recovered from all of her bad symptoms until some months afterwards the fistula closed. She then became jaundiced again and began to suffer the old pain. Operating on her again, I found that the former adhesions had nearly disappeared, the gall-bladder was now adherent only where the fistula had opened into the abdomen. Re-establishing the fistula, she immediately recovered her general health. This woman should have had an operation on the common duct in which there are doubtless obstructing calculi, but she refused to go to the hospital, and her surroundings were such as to forbid such an operation at her home. She is now pregnant, but, excepting for her fistula, in comfortable health.

This case illustrates the good which may be effected in securing the absorption of recent exudations of lymph by removing the cause of irritation. At the first operation the whole field disclosed by the cut was one mass of adhesions. At the second, with the subsidence of the irritation, I found that the inflammatory products had almost entirely disappeared, and yet the woman is not well. Sooner or later the gall-stones lodged in the common duct are certain to cause renewed inflammation and distress. The operation of cholecystotomy is nevertheless of great service in these cases where, for any reason, it is not advisable to operate immediately on the common duct. It relieves distress, enables the patient to recover appetite and strength, permits the absorption of inflammatory products, and thus paves the way for the more radical operation on the common duct, which alone will give full relief.

Now, as regards the operation on the common duct, which, in my opinion, a surgeon ought never to hesitate to perform for jaundice caused by calculi, the method chosen must vary with the condition of the patient and the seat of obstruction. Recent cases of obstruction must of necessity offer the best prognosis and easiest operations. There are then no adhesions, no inflammatory masses to obstruct the view of the surgeon, none of the complications, such as abscesses, intestinal strictures, and the like, which are to be found in old cases.

A woman, aged thirty-eight years, came to me on January 9 with jaundice of five months' duration. She was taken when in the seventh month of pregnancy with an attack of colicky pains which lasted four days. She became jaundiced, lost appetite and flesh, and became inflicted with an intolerable itching. Her passages were thenceforward of a clay color and bad odor, and her urine was continuously charged with bile. She went, nevertheless, to her full time, passed through her confinement without difficulty, and was able to nurse her baby. When I first saw her she was free from fever, had a dark-yellow color and a haggard look, and was covered all over with scratches made by her own nails. Examination of the abdomen revealed nothing abnormal. An operation was advised, to which, however, she did not consent until early in March. On March 6, she entered St. Mary's Hospital, and was prepared as usual for an abdominal operation. On March 7 I operated on her. An incision was made through the rectus muscle to the right of the navel and the peritoneum opened for the introduction of a finger. On making a digital examination of the neighboring organs I found the liver somewhat enlarged, the gall-bladder full of bile, but containing no stones which could be felt, and the cystic and common ducts apparently free from all induration and swelling. Enlarging the opening and carrying the hand down to the pancreas I felt what seemed to be a tumor in the head of the pancreas. I now cut an opening through the omentum and incised carefully the meso-colon over the swelling. An exploring needle introduced into the tumor came upon a hard substance, which could be nothing else than a calculus. Carefully turning the pancreas over I tried to uncover the common duct where it runs behind the pancreas, but found it completely surrounded by the gland. I did not hesitate to cut through the gland and duct-wall directly onto the stone. When released by the incision it popped out onto the abdominal wall as if discharged by a pop-gun, showing thus the pressure under which it was held. The gland substance at the seat of the cut was about one-sixth of an inch in thickness and not at all vascular. Only a moderate amount of bile flowed through the opening. The stone was nearly round and had no facets. It measured two inches in circumference and weighed fifty grains. The wound in the pancreas and duct was carefully closed with kangaroo tendon, and the meso-colon sewed together over it. A rubber drainage-tube was carried down to the spot, the abdominal wound closed, and the usual dressings applied. The gall-bladder was left entirely undisturbed. The result of the operation during the next two days was unpleasant and not at all reassuring. The itching became more intense and the color of the skin changed from a brown to nearly a black. After that she began slowly to lose the color of jaundice, but it was fully three weeks before the abnormal yellow had left her skin. Two weeks after the operation a small abscess developed in the abdominal wall, but otherwise her recovery was uneventful. She left the hospital for her home on April 6, apparently well.

This history illustrates a class of cases which, until very recently, were doomed to long years of suffering, which in many cases ended in premature death. With such large calculi, the only hope of relief would be by ulceration and discharge of the stones into the bowel.

The dangers incident to this process are, however, very great. Abscesses are apt to form and break into the peritoneal cavity. If this does not occur, adhesions which bind neighboring organs together long afterwards tease and annoy the patient, and even when the calculus finds its way into the gut, the danger caused by its presence is not over. There are now many cases on record of intestinal obstruction caused by the presence of gall-stones in the bowel. I have myself had one, the history of which will bear repetition in this connection. It happened in the person of a patient of Dr. Chapaton, of Detroit.

A woman, aged fifty-five years, had since childhood suffered from frequent attacks of bilious colic. She stated that she had long felt a hard lump in the right side of the abdomen. After an unusually severe colicky attack, the lump suddenly disappeared and there was temporary relief from pain. She began, however, soon to suffer pain again, and vomiting and other symptoms of obstruction became manifest. On operating, I found the bowel occupied at the junction of the jejunum and ileum by a large gall-stone which completely filled its lumen. I extracted it after incising the gut. It was found to weigh 250 grains. It had succeeded in passing, though with difficulty, through the jejunum, but, on reaching the narrower part of the bowel, had caused such terrific irritation as to produce a volvulus. It was interesting to note in the condition of the mesentery the traces of the severe struggle, for the mesentery for a long distance was marked by streaks and patches of extravasated blood. The patient made a good recovery, but owed little thanks to the conservative medicine which had permitted her for years to bear her malady unrelieved.

Returning to the question of operation, such a case as this I have reported in which the calculus was extracted through the pancreas, must be regarded as one of the easiest. The woman had been recently confined, her abdominal muscles were relaxed, she had lost much flesh, and her abdomen contained but little fat. There were absolutely no adhesions and no complications. The surgeon could not ask for an easier case. Far different are those cases in which the operation must be made through hard, thick abdominal walls, on patients whose vital forces through long-standing disease have become enfeebled, and whose abdomens are occupied by old inflammatory indurations, which bind all organs together, obliterate all landmarks, and make every movement on the part of the surgeon one of peril.

The pages of Riedel and Kehr present cases in which enormous difficulties have been overcome by a pluck, patience, and courage which extort the admiration of the surgeon. They all, however, sing one song which the practitioner may listen to with much profit. It is the warning against delay. The delay which permits a patient to suffer for years from colic and abdominal distress, which lets him become jaundiced, weak, and enfeebled, and which suffers the abdomen to become filled with indurated tissues which hinder the movements of all abdominal organs. In old neglected cases, the difficulties are such as to call for all of the resources of the most experienced surgeon. I do not purpose in this paper to discuss all these difficulties or the methods of overcoming them, but I must call attention to two points in the after-treatment upon which I think a uniform success will depend. These are immediate suture of the gut and proper drainage. Certain authors have advised and practised the method of incising the duct, and leaving it unsutured to heal by granulations. This seems to me an error in practice. In these cases, as in all others, the effort should be to secure union by first intention, and this is put out of the question, if the incision in the duct is not sewed together. Even though the sutures do not hold, they accomplish good by preventing the escape of bile until the peritoneal cavity has become shut off by adhesions from the seat of injury. This takes place in twenty-four hours, and it is a poor suture that would not hold that long. In many cases the duct will heal by first intention. This happened in a case which I have just reported. After the duct and pancreas were sutured not a drop of bile escaped. I am inclined to think that an incision through the pancreas into the duct may be preferable to one through the naked duct wall for the reason that the surgeon is enabled to apply two or three tiers of stitches, and thus fortify the tissues against the escape of bile. The immediate result after operations on the common duct is sometimes to cause an immediate exacerbation of symptoms. This happened as I have reported in my own case. It is probably due either to a clogging of the duct with coagula of blood or to an obstruction by swelling of the incised membranes. There is always danger of a subsequent escape of bile through the wound in the duct, and, therefore, drainage by a rubber tubing is in my opinion the only proper practice in cholecystotomy.

Drainage by means of gauze is to be avoided, for gauze does not act efficiently as a drain for bile. This is especially true of iodoform gauze. I lost one patient after the extraction of a calculus from the cystic duct by trying to treat it without suture, and with iodoform gauze drainage. There had been considerable oozing, and I had flooded the abdominal cavity with water, a practice which I have since entirely abandoned. The wound in the cystic duct was deep and inaccessible, and I contented myself with inserting a gauze drain. On the next morning the dressings were saturated with bloody water, but no bile. The temperature was normal, but the patient complained of great pain. On the second morning the temperature began to rise, and the iodoform gauze was removed. Its withdrawal was followed by an enormous discharge of bile, and yet the gauze itself was hardly stained. The patient died of peritonitis. Here, then, was a gauze drain which acted with great efficiency in regard to the conduction of water, and not at all as a drain for bile. Whether the fault lay in the gauze or in the chemicals incorporated with it, I am unable to determine.

In conclusion, I would urge upon a general practitioner the careful study of what has been done of late years by surgeons in relieving the distressing maladies which have their seat in the upper part of the abdominal cavity. The greater number of those are connected with maladies of the gall-bladder and gall-ducts. The presence of gall-stones, the occurrence of inflammations in the gall-passages due to sepsis conducted from the intestines, the formation of adhesions between the viscera, and the growth of cancers and tumors in these and neighboring organs can often be diagnosticated only by exploratory operations, which, fortunately, if properly conducted have little danger. The most of the maladies of these regions can be cured or relieved by surgical operations, some by the natural processes of cure, and a few, a very few, by internal medication. How long, then, shall we permit such patients to suffer their woes without instituting rational measures for their relief?

# ON GALL-STONES.

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AT the Annual Meeting of the British Medical Association, held in Bristol in 1894, I read a paper entitled "The Anatomy of the Right Hypochondrium, in Relation Especially to Operations for Gall-Stone."[1]

In that paper I pointed out that underneath the right lobe of the liver there exists a pouch hitherto undescribed, shut off by natural barriers from the general peritoneal cavity. The accompanying figures, drawn for me by Dr. A. T. Richardson, Demonstrator of Anatomy, University of Durham College of Medicine, illustrate the pouch described with its boundaries,—for a fuller description of which the paper referred to may be consulted by those interested.

By the relation of nine cases in which the operation for gall-stone was performed in accordance with the principles I was advocating, I endeavored to show that the secret of success in gall-stone operations was efficient drainage of the pouch demonstrated.

The object of my present contribution is by the relation of subsequent cases to draw attention to some points which have specially interested me, and to emphasize my belief in the importance of a recognition of the anatomy of the right hypochondrium.

The series of cases on which the bulk of my remarks are based are:

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[1] British Medical Journal, November 3, 1894.

Case I.—Mrs. A. D., aged forty-two years, a patient of Dr. Redmond, of Gateshead-on-Tyne, complained of a rounded swelling in her abdomen.

*History.*—Three years ago she began to suffer from attacks of "spasms," described as pains commencing in the stomach, making her sick, shiver, and sweat. These attacks recurred about every three weeks for two years. One year ago, after an attack, she discovered the lump by accident, and since that time has had no pain till a week before I saw her. The lump was always movable, and she could feel it as distinctly as if it were in her hand. A week ago she was taken with pain in the "lump," which extended all over her right side to the navel, round her back, and over the chest. She vomited a quantity of green matter, felt hot and cold, and was very depressed. Since then the lump has been tender and painful, her appetite has been poor, and she has been depressed and ill.

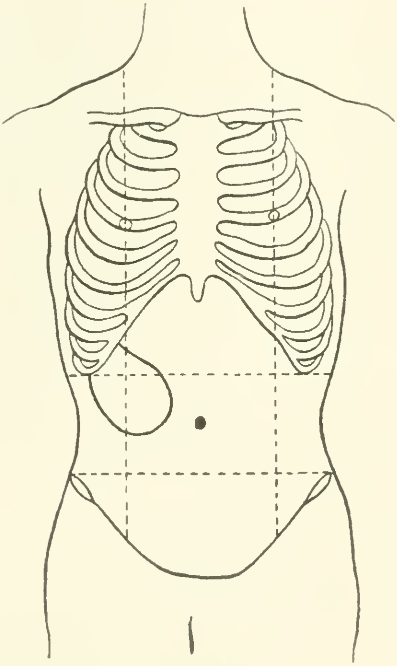

Fig. 1.—Mrs. D.

On examination a rounded swelling like a small cocoa-nut is felt projecting from underneath the costal margin in the right hypochondrium. (See Fig. 1.) It naturally lies with its long axis in a line drawn from the ninth costal cartilage to the umbilicus, but can be pushed easily into the epigastrium on the left side, or into the right lumbar region on the right side, when it can then be felt from the loin like a kidney. The kidney is movable, however, and can be distinctly felt apart by dipping the hand behind the tumor. The swelling is fixed above, moves directly downward on forced inspiration, and on percussion is dull all over its central portion.

*Operation.*—September 11, 1894. A transverse incision commencing at the outer edge of the right rectus muscle, about one inch below the tip of the ninth rib and extending into the loin opened the abdomen. The distended gall-bladder was turned out and its projecting fundus incised. A pint of clear mucus escaped at first, and towards the end about two ounces of pure pus.

The gall-bladder was washed out and then three large (size of Spanish nuts) and twenty-eight small stones were removed. The largest of them was firmly impacted at the neck of the gall-bladder, but was easily pressed back into that viscus and lifted out. A very small soft stone in the cystic duct, which could not be easily got at, was crushed.

The opening in the gall-bladder was attached to the muscles and peritoneum of the inner portion of the parietal wound by interrupted catgut sutures and the gall-bladder drained. The remainder of the wound was closed by three tiers of catgut sutures.

*After-Progress.*—The patient was immediately relieved by the operation which appeared to cause no disturbance, for her temperature never exceeded 99.2° F. or her pulse 100. For the first ten days small particles of the crushed calculus and bile escaped freely, then in diminishing quantities. In three weeks the wound was entirely healed and the patient in good heath.

Case II.—M. N., aged twenty-five years, a patient of my colleague, Dr. Hume, who has kindly allowed me to make use of the notes, complained of a swelling in the right side.

*History.*—A month ago, the patient having recently recovered from a confinement, was attacked with severe pains in the stomach and vomiting. Shortly after its commencement the pain became localized in the right side, where it continued, gradually getting less, for three or four days. A swelling was then discovered by her medical attendant. After the first four days she has had no pain, but believes the "lump" has increased in size.

There is nothing to note about her previous health or family history. The patient is a fair-complexioned, healthy, and strong-looking young woman.

*Local Condition.*—The right hypochondrium and lumbar regions are occupied by a rounded, sausage-shaped swelling situated immediately under the abdominal wall. It moves freely downward on forced inspiration, and above it the sharp edge of the liver can be felt. It is easily felt like a kidney with one hand in front and the other behind, but can be pushed over to the left into the epigastrium. (*Vide* diagram.)

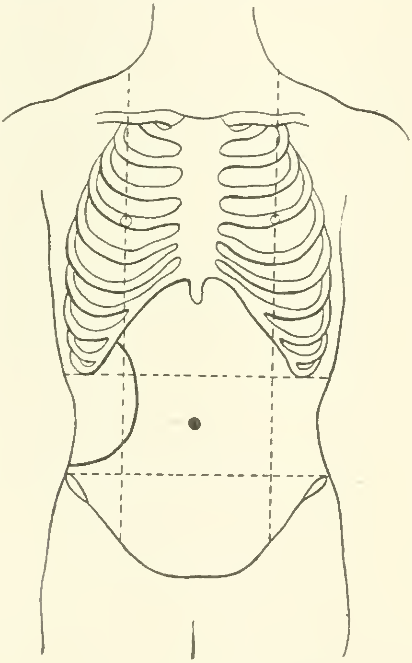

FIG. 2.—Mrs. N.

*Operation.*—December 23, 1894, by Dr. Hume. Transverse incision exposed the distended gall-bladder, which was aspirated and about ten ounces of clear mucous fluid withdrawn. The gall-bladder was then opened and four large stones removed. A fifth stone, the size of a Spanish nut, was then found firmly impacted in and stretching the cystic duct. It could not be pushed back into the gall-bladder. The stretched duct over it was incised, and the stone squeezed out of the opening. The wounds in the duct and the gall-bladder were closed by sutures and the whole returned into the abdominal cavity. A drainage-tube was left in the lower angle of the wound with a strip of iodoform gauze, and the abdominal wound closed except at its most dependent part.

*After-Progress.*—December 25, 1894 (forty-eight hours after operation). The copious dressing applied at the time of the operation was found to be saturated, and was changed. The fluid in the dressing was more like peritoneal exudate than bile.

December 27. Dressed and gauze plug removed.

December 30. Drainage-tube removed, as there was no discharge from it. This patient was never ill after the operation and the wound healed by first intention, except where the drainage-tube had been.

CASE III.—Mrs. E. W., aged forty-five years, patient of Dr. Binnie, Brandow, complained of attacks of pains in the right side.

*History.*—One day in July, 1893, the patient was suddenly seized with severe pain in the region of the liver. The pain shot round the body, over to the stomach, and up into the right shoulder. It was accompanied by sweating and sickness, and followed by shivering and sweating, but no jaundice. The pain lasted for two hours, but the resulting weakness confined her to bed for three weeks. Three months after the first she had a second severe attack, and was in bed for a fortnight, during which time jaundice was noticed for the first time. The pain has never been entirely relieved since this time and the jaundice has never entirely disappeared. Every now and again she has severe pain with shivering, sweating, and vomiting, always followed by a temporary increase in the jaundice. She has lost flesh considerably.

On examination, slight jaundice with tenderness over the liver and enlargement, sufficient to allow of the liver edge being felt a finger's breadth below the costal cartilages, are the only physical signs present.

*Operation.*—August 13, 1894. The abdomen was opened by a transverse incision extending from the outer edge of right rectus to outer edge of quadratus lumborum, and the liver edge exposed. The gall-bladder was buried in adhesions between omentum, hepatic flexure of colon, and pylorus. The adhesions were separated and the gall-bladder exposed. It was contracted and thick-walled, but empty. The common duct was now found to be much dilated and about its middle a large stone was felt through the walls. The duct was hooked forward, incised in a horizontal direction, and the stone, the size of a hazel-nut, slipped out. Further exploration proved that this was the only stone present. A full-sized drainage-tube was left in its inner end in contact with the opening in the duct, its outer projecting through the lower and posterior angle of the parietal incision. A small packing of gauze was put in by the side of the tube to prevent prolapse of the hepatic flexure of the colon, and the remainder of the wound was closed by three tiers of specially prepared catgut sutures.

*After-Progress.*—The gauze was removed on the third day, the tube four days later, for the bile, which had been flowing freely through the tube, had now ceased to escape in this direction, and the fæces were thoroughly bile-stained. Convalescence was uninterrupted, and in three weeks she went home well.

Case IV.—Mrs. T., aged sixty-four years, a patient of Dr. Kay, Gateshead, complained of pain in the right side and vomiting.

*History.*—The first attack dates back twenty years, and since then she has had frequent recurrences of pain. Last August (two months ago) her present illness commenced with pain in the right side and over her stomach, accompanied by vomiting, shivering and sweating, and followed by jaundice. Since then she has never been quite free from pain or jaundice, but up to January of this year was able to get about. Since the new year she has been confined to bed and in constant pain, with worse attacks every now and again, after which the jaundice increased. The only physical signs discoverable are slight jaundice, tenderness in the right hypochondrium, and enlargement of the liver.

*Operation.*—October 23, 1894. The abdomen was opened by a transverse incision extending from outer edge of right rectus to quadratus lumborum, and the liver exposed. On drawing this upward a firm omental adhesion was seen in the gall-bladder notch. On separating the omentum the pylorus, also adherent to the gall-bladder, came into view. The pylorus was separated and the gall-bladder exposed. It was thick-walled and contracted and contained one small stone. The whole of the structures underlying the liver were matted together, and the foramen of Winslow was blocked. A hard nodular mass was felt in the neighborhood of the head of the pancreas, but there was no sign of stone in the common duct. By further separation of adhesions the dilated duct was exposed and opened, allowing of the escape of a quantity of pent-up bile. Introducing my finger through the opening in the duct and downward I discovered at the duodenal end of the duct a stone the size of a small marble, which, with some difficulty, I got out.

The stone lay in a cavity under the head of the pancreas, surrounded by indurated and matted tissues. After the removal of the smaller stone from the gall-bladder the operation was completed by draining the cavity from behind, packing some gauze in below, and suturing the remainder of the wound. The operation was well borne, notwithstanding its severity and the bad state of health, and the patient was put to bed in good condition.

*After-Progress.*—For the first three days progress was satisfactory, then the wound-edges began to look red and some suppuration appeared. A bedsore, which had threatened before the operation, now became troublesome. The operation wound became foully septic, and on the eighth day the patient died.

*Autopsy.*—Along with Dr. Kay I made a post mortem on the following day. The only trace of peritonitis in the general peritoneal cavity was a recent adhesion of the omentum in the pelvis, such as would follow sponging the omentum in an aseptic abdominal case. There was no fluid in the general peritoneal cavity, and the intestines were not discolored or distended. The pouch I have described was entirely shut off by firm adhesions from the general peritoneal cavity. Bile was still escaping into it from the opening in the duct, and the whole lining of the pouch was in a foul, purulent condition.

Obviously death arose from septic changes in the pouch due to an infection of it, I believe, from without. The room and bed, as most beds in private houses are, were unfitted for the operation and after-treatment of such a case, and the difficulties of keeping the wound healthy were not surmounted, as they would almost certainly have been in a properly equipped institution. This difficulty was, however, of the patient's own making, for she obstinately refused to leave home.

I may mention here that this is the only death I have had following or consequent upon an operation for gall-stones, which I therefore regard as one of the safest of abdominal operations.

Case V.—E. K., aged thirty-five years, a patient of my colleague, Dr. Hume, who has kindly allowed me to use his notes, complained of pains in her right side.

*History.*—One year and nine months ago the patient was confined and the day after her confinement, which was a severe one, she was seized with a bad pain in her right side which lasted two hours. Six weeks after this she had another attack. Since that time the pain has occurred at intervals, at first coming once a month, then once a week, and during the last fortnight she had an attack every day, and the pain lasted longer (about five hours at a time now). She thought her pain was brought on by a meal, but abstinence from food for twenty-four hours failed to prevent it from coming. She has always been sick and shivering with the pain and becomes jaundiced after each attack.

*Present Condition.*—The patient is a very feeble, emaciated, dark-complexioned woman, distinctly jaundiced. Physical examination reveals nothing.

*Operation.*—January 16, 1895, by Dr. Hume. Abdomen opened by transverse incision and gall-bladder exposed. A stone was felt through its walls. The gall-bladder was opened and the stone extracted. On examining the ducts, a second small stone was felt in the common duct. This was pushed down into the duodenum. The opening in the gall-bladder was closed by Lembert's sutures, returned into the abdomen, and an India-rubber drainage-tube was left in the lower angle of the wound, which, except at its lower end, was closed by sutures.

*After-progress* was uneventful, and the patient went home on the twentieth day, with the wound healed, except for a few granulations where the tube had been, and in much improved health.

CASE VI.—Mrs. D. F., aged forty-seven years, patient of Dr. Campbell, Heaton, Newcastle, complained of pains in right side and jaundice.

*History.*—Five years ago she had the first attack, and was in bed for three weeks with what was called a gall-stone colic. After recovering she had several slight attacks, which troubled her occasionally up to last March (eight months ago). In March she had a very bad attack, and was in bed for three weeks. From this up to September she was frequently ill, but the attacks passed off quickly. In September (two months ago) the last attack commenced and she has had more or less pain and jaundice since. For the last three weeks she has been too ill to leave her bed. Each painful attack was accompanied by vomiting, shivering, sweating, and followed by jaundice. For the last two months the jaundice has never disappeared, but has been worse after each attack of pain.

*Previous Health.*—She was always bilious, but otherwise healthy. Has had six children. Brain fever at thirteen years.

*Family History.*—Father and mother both lived to be over seventy. She has had five brothers and two sisters, all of whom died of consumption.

*Present Condition.*—November 17. Depressed and ill-looking; considerable jaundice; sordes on lips and teeth; tongue red and dry. Seems to be in constant pain. On physical examination nothing is discoverable except abdominal tenderness in right hypochondrium and enlargement of the liver. Six weeks earlier I saw the patient with Dr. Campbell, when we were both able to feel the tense and distended gall-bladder and advised operation.

Her general condition was now so bad that I postponed operation, relieving her pain by morphia and feeding her on light nutritious articles frequently and in small quantities, with the hope that she might improve somewhat.

On November 17, she had a bad night with vomiting and pain and perspired profusely.

November 18, at 8 A.M., she had a rigor, and her temperature was 104° F. When this passed off she was bathed with spirits and water and a large hot linseed poultice applied over the liver. By the evening her temperature had come down to 100° F., and she had a good night.

November 19. This morning she seemed better. At 7 P.M. she was badly pained and had morphia. Her temperature was 102.8° F.; at twelve o'clock her temperature was 104° F., and continued so all night and till twelve o'clock on November 20, 1894.

Her pulse never rose above 112, in spite of her severe illness, and I have noticed a slow pulse in other jaundiced patients. It was obvious to all of us on the morning of November 20 that operation gave her the only chance, and the patient herself, an exceptionally intelligent woman, very strongly supported the view that it should be done at once.

*Operation.*—November 20, at twelve o'clock. The abdomen was opened by a transverse incision extending from outer edge of rectus to outer edge of quadratus lumborum and the margin of the enlarged liver was exposed. The gall-bladder and under surface of the liver could not be seen for adherent omentum and viscera. The firm adhesions were separated and the gall-bladder brought into view. It was of normal size, thick walled, and contained fluid bile, but no stones. On further separating adhesions a collection of pus and bile (about four ounces) escaped from near the junction of the cystic and common duct. So far as I could judge this collection was outside of the ducts and limited only by adhesions. The discharge was now cleared away by sponging and the common duct explored. A stone could be felt in it about the middle of the gastro-hepatic omentum. The stone was fixed between my finger and thumb, a longitudinal incision made over it, the scoop inserted behind it, and the stone turned out. Each side of the wound in the duct was secured by clip forceps before relaxing the grasp, and my finger introduced through the opening in the duct, which was so largely distended that my forefinger explored it with ease as far down as the duodenal orifice and as far up as the hepatic ducts. No further stone was felt. A large India-rubber drainage-tube was left in with its inner end in contact with the opening in the duct, its outer projecting through the posterior extremity of the wound. Some gauze packing was left surrounding the tube, the end of the gauze being left out in the same situation. The abdominal wound was closed by silk sutures passed through all the layers to save them, the lower four being left long, tied in a bow-knot for the purpose of untying when the gauze had to be removed, as described in a paper of mine on "The Use of the Tampon and Temporary Suture in Abdominal Surgery," published in the *Northumberland and Durham Medical Journal* of October, 1894.

*After-progress* was uneventful. The day following the operation the patient was decidedly improved. On November 23 (seventy-two hours after operation) the lower sutures were untied and loosened, the gauze plugs were removed, and the sutures permanently tied. After the first day the discharge had been trifling.

November 26 (a week after the operation) the sutures and drainage-tube were taken out.

December 3 (a fortnight after the operation) the patient left for home, well and with the wound healed. The four hours' temperature chart shows the high temperatures up to the time of operation, and the steady fall afterwards.

CASE VII.—E. H., aged twenty-eight years, a patient of my colleague, Mr. Page, to whom I am indebted for the notes, complained of jaundice.

*History.*—Three years ago, while doing her house-work, was seized suddenly with a severe pain in the pit of the stomach. The pain was tearing in character, and shot through to her back. It made her feel faint and doubled her up. She did not vomit, but felt sick. The pain lasted about one and a half hours. It was not followed by jaundice. After this she had an attack every month in all respects similar to the first, until sixteen months ago, when they suddenly ceased. Three months ago she had a very bad attack, which was accompanied by vomiting and followed by jaundice on the second day. Since then she has had three attacks, the last four days before her admission to the Royal Infirmary. Her previous health had always been good. She is the mother of five children. Her mother died of cancer of the stomach; one sister of consumption.

*Present Condition.*—Patient is a healthy-looking, well-nourished woman. Her skin presents a slightly icteric tinge. Except for great tenderness in the epigastrium, nothing is discoverable on physical examination.

*Operation*, November 10, 1894, by Mr. Page.—Abdomen opened by a vertical incision in right linea semilunaris and liver exposed. The adherent duodenum was separated from its under surface, when the dilated common duct came into view. A calculus was felt in it. The duct was drawn forward and incised over the calculus, which then dropped out. Two smaller triangular calculi were subsequently removed from the ducts. Nothing was felt in the gall-bladder. A long pair of closed forceps were passed down to the bottom of the pouch, just below the right kidney, and cut down upon from the loin. A drainage-tube was then drawn through the opening and placed so that its inner edge lay in contact with the hole in the common duct. The anterior wound was completely closed.

*After-Progress.*—The dressing over the tube had to be changed daily at first on account of the large quantity of bile which drained through it. On the ninth day the sutures were removed from the anterior wound, which had healed by first intention. On the eleventh day the drainage-tube was taken out. Convalescence was unattended by any constitutional disturbance, and the patient went home on the twentieth day in good health.

Case VIII.—Mrs. W., aged thirty-three years, patient of Dr. Sutherland, South Shields, complained of abdominal pains.

*History.*—The patient caught cold two months ago, and had a severe pain in the left side of the abdomen, low down and in the sacral region, which confined her to bed for ten days. The pain passed up to between her shoulders and spread over the abdomen. She last menstruated three months ago. During the last three months she has had three attacks of gall-stone colic, two of them being very severe. During the last week the pain low down in her back has been much worse.

*Previous Health.*—One child seven years ago; none since. For the last eight years she has had occasional attacks of gall-stone colic. Pain in the right side, vomiting, shivering, and sweating, followed by jaundice, were the symptoms produced. The worst illness occurred three and a half years ago, when she was confined to bed for six weeks, in consequence of a prolonged seizure. As a rule, the pain lasted for about an hour.

*Present Condition.*—A dark-complexioned, depressed-looking woman, with poor appetite, clean tongue, and constipated bowels. On examination a rounded elastic tumor is discovered in hypogastrium, reaching two inches above pubis. In right hypochondrium a rounded nodule, size of a walnut, can be felt in connection with the lower sharp margin of the liver, and in the position of the gall-bladder. From the loin and ilio-costal space a slightly movable kidney is felt. The anterior fornix is bulged by an elastic, rounded, tender swelling, continuous with the hypogastric swelling. A depression exists between the swelling in front and the small lower portion of the body of the uterus, which can be felt.

*Operation.*—December 21, 1894. Chloroform was administered, and a thorough examination was made, as the possibility of an extra-uterine pregnancy complicating gall-stone had not been excluded. This examination made it almost certain that the pelvic swelling was an anteflexed pregnant uterus. The abdomen was then opened by an incision above the umbilicus in the right linea semilunaris, and before going further I introduced my hand and verified the observation made as to the nature of the pelvic tumor. The distended gall-bladder was then opened; a mass of soft gall-stone *débris* and bile removed from it; the gall-bladder opening was sutured to the parietal peritoneum and muscles and drained, and the remainder of the abdominal wound closed.

*After-Progress.*—The patient was absolutely undisturbed by the operation, her temperature and pulse never rising above normal. She went home on January 5, 1895 (a fortnight after the operation), with the wound healed, except a small superficial granulating area where the tube had been. In this case I chose the incision in the linea semilunaris because it was easier to explore the pelvis through it than through a transverse incision, and I sutured the gall-bladder to the wound, as I did not wish to make a second incision in the loin or disturb the abdominal contents more than necessary in a pregnant woman. This is the second case in which I have operated for gall-stone during pregnancy without damage, and when the British Medical Association met in Newcastle, in 1893, I exhibited the other woman on whom I had operated for gall-stones in the fifth month of pregnancy. She made an excellent recovery from the operation, and was delivered at full time of a healthy child.

CASE IX.—Mrs. F., aged fifty-six years, a patient of Dr. Hutchinson, Fence Houses, complained of abdominal swelling and pain.

*History.*—Nine months ago she had a severe attack of pain in the right side, shivered, and vomited. This was followed by jaundice, which lasted for a few days, and then she got well. Ten days ago she noticed a lump like a baby's head in her right side, which caused her pain. It has grown larger, and she has been confined to bed with illness.

*Present Condition.*—The patient is in a feeble, apathetic condition, with a gray skin, but looks as if she had been a strong woman. In the right hypochondrium there is a prominent fixed swelling the size of a foot-ball. The skin over it is red, and fluctuation is distinct. On June 25, 1894, the large abscess was incised by dividing the skin freely. About a quart of offensive pus escaped. Under the abscess a hard, rounded tumor (size of a fœtal head) could be felt, but the connection between this and the abscess could not be traced.

*After-Progress.*—The patient improved to a limited extent soon after draining the abscess, but neither her condition nor that of the wound ever reached such a satisfactory stage as to allow of further operation, and she died on August 4, 1894, a little over six weeks after the abscess was opened.

On post-mortem examination I found that the hard tumor under the abscess was formed by the right lobe of the liver with matted omentum and intestines. In the centre of the hard mass there was a cavity containing a small quantity of pus and two gall-stones. Part of the wall of the cavity was formed by the remains of the ruptured, suppurating gall-bladder.

This case is recorded with the object of emphasizing my idea that death is a not uncommon result of gall-stone.

*Remarks.*—It is a generally accepted belief, and one based upon sufficient evidence, that gall-stones are formed in the great majority of cases in the gall-bladder.

Mucus seems to be essential to their formation, and this is only secreted by the gall-bladder and the larger ducts. The circulation in the larger ducts is so constant that deposition of salts and inspissation of bile would be difficult there, but in the gall-bladder the relative stagnation and other conditions are favorable to gall-stone formation. Though gall-stones are frequently found in the smaller ducts, it does not follow that they are formed there. It is not difficult to believe that they are carried and deposited by a back flow of bile, which must be of common occurrence in the complicated biliary circulation.

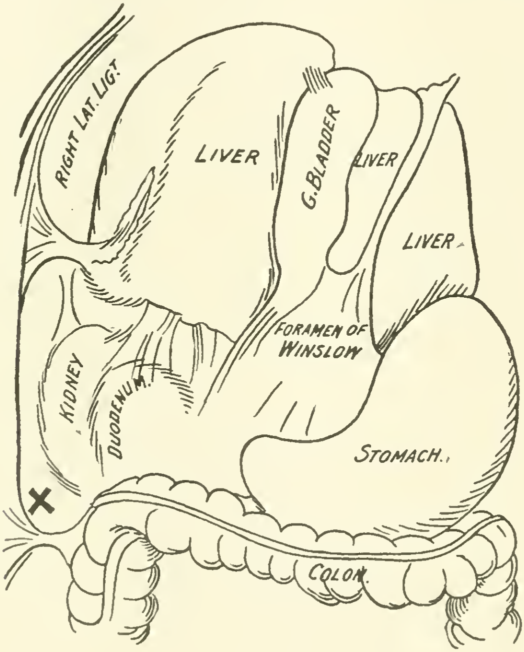

FIG. 3.—The pouch described shown by drawing liver upward. X in all the figures marks points for drainage.

*Symptoms.*—There can be no doubt but that gall-stones are frequently present in the gall-bladder, without causing symptoms that something more than the mere presence of the stones is necessary to excite an attack of colic.

The same is true of urinary calculi. A renal or a vesical calculus (especially oxalate of lime) may be present for years without producing symptoms, and large urinary calculi have been found post mortem, which have called for no attention during life.

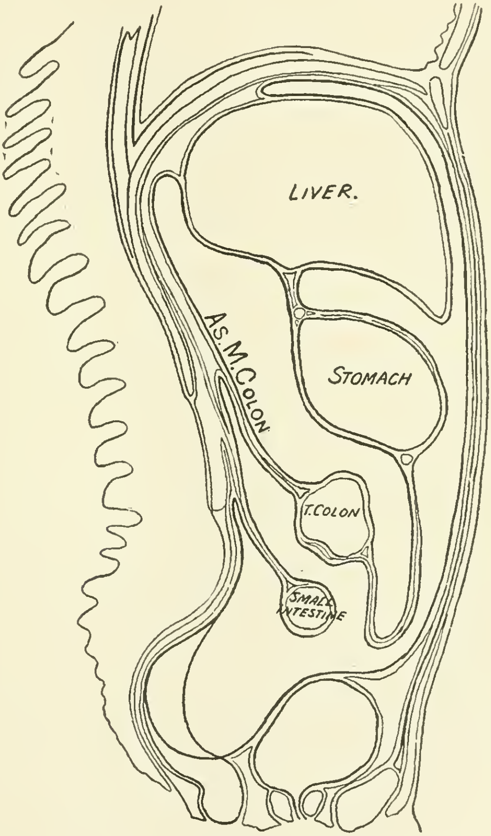

FIG. 4.—Vertical mesial section. Showing barrier below and internally formed by ascending meso-colon.

I have in my possession an oxalate stone the size of a bantam's egg taken post mortem from the body of a nervous hypochondriacal man, who complained of no urinary troubles during life, and it is no uncommon thing for surgeons to find during operations a large stone in the bladder, which must have taken years to form, but has only caused symptoms for weeks.

An attack of pyelitis or cystitis is often the first evidence of a urinary calculus.

Is not a similar explanation true of biliary calculi?

*Pain* is the most frequent symptom in gall-stone attacks, and having often sought for an explanation of it without any satisfaction, even the lesser one of seeing an attempt made to suggest a cause for it, I am forced to draw my own conclusions.

It is easier to say what the pain is not due to than what is its cause. It is safe to say that it is neither due directly to the presence of the stone nor to the distention of the gall-bladder or ducts, as the stone will lodge in one or other indefinitely without producing pain, and the ducts and gall-bladder are frequently enormously distended with trifling disturbance. The only pain I know of to compare with it in severity is that due to the forcible contraction of unstriped muscular fibre. Labor-pains supply a good physiological example of pain from this cause, the painful contractions of an irritated bladder or intestine will occur to the mind of every one as a common pathological illustration having a similar origin.

The intermission and uncertainty of the pain, as well as an absence of proportion to its exciting cause, are additional resemblances it has to the pains produced by forcibly contracting unstriped muscle.

There seems to me also fair reason for believing that the pain is the result of gall-bladder contractions, for there is a very small amount of unstriped muscle in the ducts, and when the gall-bladder becomes incompetent the pain ceases.

The vomiting, shivering, and constitutional disturbance may, I think, as in urinary cases, be attributed to toxæmia or nervous disturbances; the latter claiming the minority.

The *diagnosis* of gall-stones may be impossible without exploratory incision, but it is more easy than most of the other abdominal diagnostic problems. It is easy because the diagnosis is based on either a gross physical sign, such as a distended gall-bladder, or on jaundice; or upon a history, the details of which are so vividly impressed upon the mind of even the dullest patient, as to make a reliable one obtainable.

It will be noted of the first case related that three years before the operation she began to suffer from "spasms," and that they continued for two years. Judging from what I have observed in other cases, an opportunity of examining her then would have shown a distended gall-bladder, the distention varying in amount, and a small stone, such as one of those we found in her gall-bladder and its duct, partially obstructing the cystic duct. It is too often forgotten, in making a diagnosis, that no jaundice will follow blocking of the cystic duct by a stone, and cases of this sort are frequently diagnosed "spasms."

*When the gall-bladder is distended without jaundice and pain after the first acute attack is absent, a stone has completely blocked the mouth of the gall-bladder or the cystic duct.*

A reference to the history of Case I (mouth of gall-bladder blocked) and Case II (cystic duct blocked), in both of which the block was complete, shows that after the swelling was discovered pain ceased. In Case I it was only when the contents of the gall-bladder suppurated, after a year of distention, that pain was experienced. In Case II pain had not returned up to the time of the operation.

In Case I the diagnosis was easy, because the gall-bladder line was in its normal direction (from ninth costal cartilage to umbilicus), and the kidney could be felt behind it.

In Case II the position of the tumor might be misleading, but its evident connection with the liver and the way in which it could be pushed over into the epigastrium with its superficial position, made the diagnosis far from difficult.

When the gall-bladder is adherent, with its long axis directed downward, and the swelling fills the right lumbar region, a diagnosis is impossible, as I have more than once experienced.

Perhaps the best single diagnostic guide in these cases is to believe that a tumor which is not distinctly and readily discernible is likely to be the gall-bladder.

*Attacks of severe pain in the epigastrium and right hypochondrium, accompanied by vomiting and shivering, and followed by sweating, complete relief and transient jaundice, are due to the passage of a gall-stone from the gall-bladder through the ducts into the duodenum.*

Careful washing of the fæces (best performed on a wire sieve) will rarely fail to discover the stone or stones in such a case.

A patient of mine passed and recovered in one year 200 stones, usually about the size of a horse-bean, and for seven years was free from recurrence, when she was again attacked by her old malady. In such a case it is of course impossible to say that the gall-bladder was emptied, even after 200 stones were passed, and the same uncertainty must exist in all cases which are treated other than surgically.

*If the relief after the attack is incomplete, the jaundice more or less persistent, and the patient attacked by ague-like paroxysms, generally with, but perhaps without, pain, each attack being followed by a temporary increase of jaundice, a stone is impacted in, but not completely blocking, the common duct.*

Dr. Osler, of Baltimore, specially drew attention to this form of disturbance in an excellent paper,[1] entitled, "On Fever of Hepatic Origin, particularly the Intermittent Pyrexia associated with Gall-Stones," and several of the cases I have recorded are good illustrations of the points stated.

Looking at the size of the stones removed, it is easy to convince one's self that they only partially obstructed ducts which were dilated enough to admit a large index-finger with ease. The obstruction the stone does cause can only be an intermittent one, when it acts like a ball-valve. This excessive dilatation of the ducts is only what surgeons, who are familiar with the behavior of the urethra if a foreign body be left in it, would expect.

At first the intruder is firmly gripped, but shortly dilatation commences, and the walls of the canal tend to recede more and more from it.

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[1] Johns Hopkins Hospital Reports, 1890.

If opportunities had offered of examining the jaundiced cases in the early stages, the gall-bladder would have been felt enlarged and tender, for in the case of Mrs. D. F. and others I have had the chance of observing that it was so, as could almost have been anticipated. These cases, however, were not seen till a later stage, when the only local signs are tenderness with enlargement of the liver, for then the gall-bladder is shrunken and thick-walled, as found at these operations, and generally buried in adhesions. In the single case I have seen where there was an absence of pain, with deep jaundice and recurring ague-like attacks, with a stone in the common duct, the gall-bladder was so shrunken as to appear like a fibrous cord, was quite empty, and must have lost all function. Such cases are often thought to be due to malignant disease,—a very fatal error, as Mr. Mayo Robson, of Leeds, has emphatically pointed out: *Persistent jaundice with a distended gall-bladder and absence of severe pain are due to a complete block of the common duct, arising usually from malignant disease in its neighborhood and involving it.*

In looking for an explanation of these phenomena, familiar and easily observed occurrences in the urinary bladder serve a useful purpose.

*Like the urinary bladder, the gall-bladder will become contracted and hypertrophied when dealing with a partial obstruction, and like it will dilate painlessly when all its efforts to overcome the obstruction are futile.*

*Prognosis.*—I have seen several deaths from gall-stones, but will quote Dr. Wickham Legg[1] on this point: "It is almost impossible to make a trustworthy prognosis in these cases. The physician can never speak confidently or feel quite happy when treating a case which he looks upon as one of gall-stones."

I feel confident, when operations are performed before patients are exhausted by pain, prolonged illness, or are poisoned by their own excretions, that the prognosis will be as good as that of ovariotomy or lithotomy.

*Treatment.*—Gall-stones appear to be as resistant to solvents administered internally as any other stones, and nothing but relief can be promised from medicinal measures.

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[1] Quain's Dictionary of Medicine, 1883.

The diagnosis of gall-stones causing serious trouble would appear to me to carry with it a recommendation for operative treatment.

*Conclusions as to Operation.*—Exposure of and manipulation of the pouch described causes less shock than an ordinary abdominal section, for the small intestine need neither be seen nor handled.

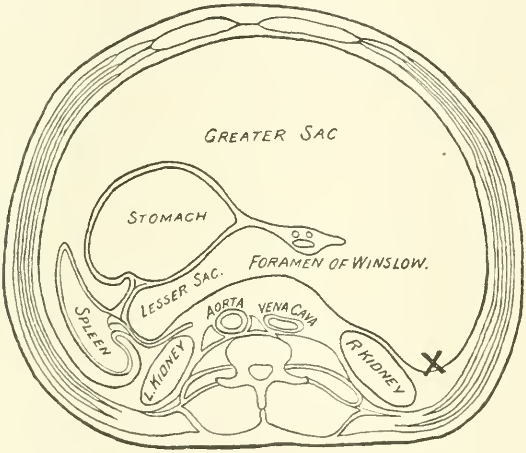

FIG. 5.—Transverse section through centre of pouch described, showing inner wall.

The pouch can be efficiently drained through an opening in the parietes near the lower end of the kidney.

A transverse is better than a vertical incision in operating for gall-stones, a piece of knowledge for which I am indebted to Dr. John Duncan, of Edinburgh. It gives better access and is less likely to be followed by ventral hernia.

Biliary fistula results from operation for gall-stones in a considerable percentage of cases in which the gall-bladder has been attached by sutures to the parietes. This method should therefore be employed as the exception (see Cases I and VI), and not like now as the rule. The method of attachment has little to do with this result, and it may follow when the ducts are patent.[1] The gall-bladder and ducts may safely be allowed to empty into the pouch described, if it is properly drained.

If the pouch is properly drained (*a*) when the gall-bladder is distended, the opening in it should be closed by sutures and the viscus returned into the abdominal cavity, and the drain left in until the certainty of its successful closure is complete, as in Cases II and IV.

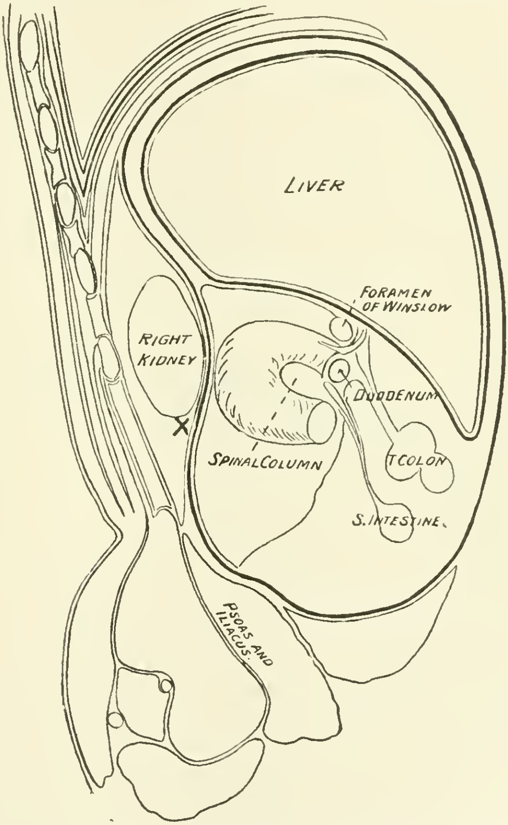

FIG. 6.—A vertical abdominal section between ascending colon and parietes on line marked A B, Fig. 7, showing rise from X over pelvic brim.

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[1] See paper by author, British Medical Journal, November 3, 1894.

(*b*) When the gall-bladder is shrunken and there is difficulty in closing the opening made in it, it may be returned unclosed as in several of the cases recorded.

(*c*) When a stone is impacted in the cystic duct, it may be excised by cutting down on it through the duct, as in Case II, or it may be crushed when small and soft, as in Case I, after which the gall-bladder must be sutured to the parietes to allow of the escape of the fragments; or if the stone is hard and inaccessible, the

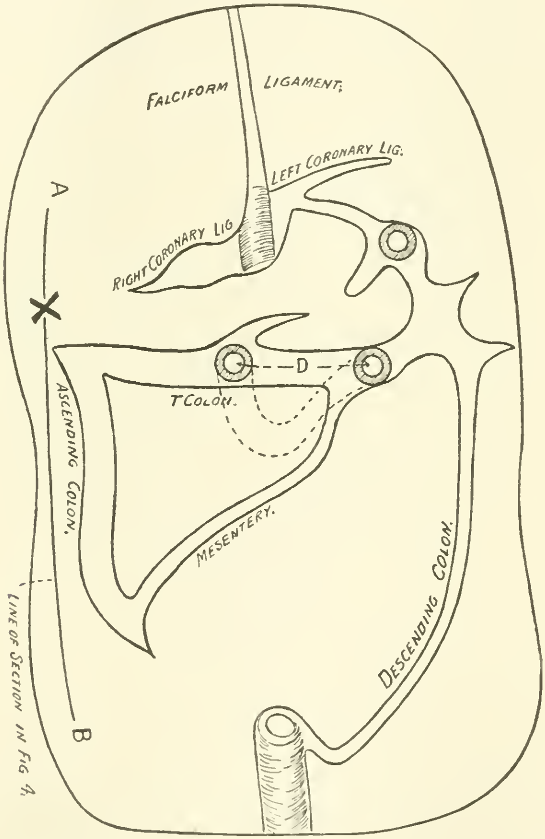

FIG. 7.—Reflections of peritoneum from posterior abdominal parietes. A B, line of section.

gall-bladder should be excised, the stone removed, and the cystic duct ligatured.

When a stone is impacted in the common duct, it depends on what part of the duct it is lodged in whether the finding of it during the operation is easy or difficult, and its removal safe or complicated.

The stone may be, and by far most frequently is, lodged in that portion of the common bile-duct before it dips under the duodenum and head of the pancreas, when it can be grasped and removed by a direct incision after exposure of the portion of duct in which it is lying, the separation of (often troublesome) adhesions being the chief difficulty, or it may be lodged, as in Case IV, in the end of the duct (ampulla of Vater), where it is entirely covered up by the head of the pancreas, and interferes with the flow from the pancreatic duct. The inability to feel the stone and the induration of the head of the pancreas in such a case may lead the operator, as I have the misfortune to know, to believe that he is dealing with a pancreatic tumor. The diagnosis can only be confirmed and the stone with difficulty removed by opening the dilated duct at a convenient spot and introducing the finger and extracting instruments down to the stone through this opening, as in Case IV.

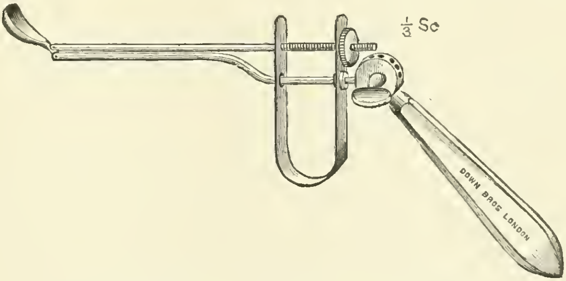

FIG. 8.—Extracting scoop for common bile-duct.

After touching the stone, the difficulties of extracting it through the incision in the duct may be insurmountable, though Messrs. Down Bros. have made at my suggestion an extracting scoop (see Fig. 8), which must make such difficulty rare.

In such a case I would suggest that an opening should be made in the convexity of the second part of the duodenum, through which a finger or probe might aid the upward dislodgement of the stone and its removal through the incision, or allow of dilatation of the duodenal orifice of the duct and its extraction through the intestine.

It appears to me that, considering the safety and certainty with which a stone can be removed by incision from the only portion of the common duct in which it could be crushed, crushing, with its risks and uncertainties, should be abandoned.

If, as I know has happened in some unpublished cases, the usual operation is followed by the fresh formation of gall-stones in even a small percentage of cases, resection of the gall-bladder will have to be made the rule.

# THE RELATIVE VALUE OF OPERATIVE AND HYGIENIC MEASURES IN THE TREATMENT OF TUBERCULOSIS AND NEOPLASMS OF THE BLADDER.[1]

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AMONG the many troublesome cases of disease of the bladder that we are called upon to treat, none are more troublesome than those due to tubercular infection. At first, the symptoms in these cases are often so obscure, and so similar to those produced by other morbid conditions, that the diagnosis is frequently doubtful and in many even impossible. Later on, the clinical picture becomes so characteristic that all doubt as to the diagnosis is removed; but, at this stage, treatment can effect but little, even in the mitigation of the sufferings of these patients, whose hope of *cure* is now out of the question. If, however, the disease can be discovered in its incipiency, and proper measures taken for its relief, I believe that it may be regarded as curable, certainly in the sense of being in abeyance.

Although I am well aware that much has been said and written on this subject, I venture to present, in brief, some cases of tuberculosis of the bladder which I think illustrate the course of the disease, and from which may possibly be deduced certain principles regarding treatment. It may be observed that they are not all cases of lesion of the *bladder*, strictly speaking, but as the prominent and early symptoms are referred to this viscus,

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[1] Read before the New York Surgical Society, May 8, 1895, and at the meeting of The American Association of Genito-Urinary Surgeons, May 28, 1895.

I have classified them thus for purposes of description. They are selected from many in order to illustrate points in diagnosis and the advantages of hygiene, even after the failure of zealous and prolonged efforts with other methods of treatment.

Case I.—H. K., a young man, aged twenty-seven years, who came under my observation on March 25, 1891. The following is a synopsis of his history: He denies all venereal diseases. Was well up to a year and a half ago, when he noticed a slight burning pain near the head of the penis on urination. It had no relation to the act of coitus. This pain gradually became more severe, and on several occasions a clot of blood came with the first gush of urine. There was no frequency at that time. This pain on urination disappeared under medical care, washing of the bladder being resorted to, and the patient married in September, 1890. A few weeks later the pain returned, accompanied by frequent micturition. There was also severe pain on coitus. He again placed himself under the care of a physician, by whose advice one of his testicles was removed; why, he could not state.

When he came under my observation in March, 1891, he had no gonorrhœa and no urethritis, but his urine was turbid and loaded with flakes and shreds. He was unable to hold his urine for over an hour, the pain and tenesmus were severe, and he stated that when he strained at stool a white substance escaped from the penis. Per rectum, both vasa deferentia and the prostate were found to be nodular, indurated, and tender. Bacteriological examinations of his urine, frequently repeated, were negative. All sorts of treatment of the bladder and deep urethra failed to relieve him; on the contrary, his symptoms were aggravated by instrumentation and applications. On June 2 the bladder was opened above the pubes, and the intensely hyperæmic mucous membrane, here and there ecchymotic, was curetted, and a counter-opening made in the perineum. For a time, through drainage was attempted, but subsequently, the perineal tube becoming intolerable, permanent drainage was maintained by the suprapubic opening. After six months of drainage (June, 1891, to January, 1892) the tube was removed. In the mean time, with the exception of the first six weeks, he had been living in the hills of New Jersey and had improved in general condition. He then returned to his work in a printing-office, free from pain, but urinating about every two hours. At the end of two weeks he had an attack of fever, anorexia, and general malaise, and a return of frequent urination, sometimes as often as every fifteen minutes. The suprapubic sinus reopened, and a month later the perineal one also. In spite of my objections he kept at his work in a close, ill-ventilated office, and his symptoms generally became aggravated until by the end of February he was unable to work. In March, 1892, I inducd him to find employment with a farmer in the same hilly country where he had been before. By the first of May, although driving a produce-wagon and exposed to all weather, he had improved greatly. He could hold his urine two to two and a half hours. He had no pain at all and could work freely. His urine was slightly turbid and contained a few shreds and flakes. He remained in the country, and in October he was holding his urine four hours and seemed well. In January, 1893, the cold became so severe that he was compelled to give up his out-of-door occupation and he went into a printing-office again. A return of irritability of the bladder and a little pain at the end of the act of urination frightened him, and he readily acceded to my direction to go to Los Angeles, Cal., where he remained till October, 1894, when he returned to New York. At this date he was apparently well, urinating once in four or five hours, without pain. His urine was clear with the exception of a few shreds and flakes, and coitus was indulged in without pain. Since then I have not seen him, but I believe that if unpleasant symptoms had developed, he would, in obedience to my directions, have reported to me.

The noticeable diagnostic symptom in this case was the pain on urination. It began without any frequency of urination and without any antecedent gonorrhœa. It was not associated with any evidence of traumatism or stone, nor was it related to any sexual excess. There was none of the burning sensation between the acts of urination which is so common in cases of gonorrhœal origin, but the pain which was developed by the function of urination was of a burning character, though slight in grade. Gradually the pain became more severe, and another feature was added,—namely, a small clot of blood with the first gush of urine, but still without frequency. These symptoms may have been due at that time to sexual hyperæmia, for they were relieved by treatment, and the patient married. But a few weeks after marriage the pain returned, now accompanied by frequent urination and by severe pain on coitus. Here was a suspicious circumstance. Sexual hyperæmia had again prepared the way for a reawakening of the original focus or had developed a new one, and at this time, in my opinion, a hygienic mode of treatment should have been insisted on. Thereafter all instrumentation, all applications, all local and surgical measures, including unilateral orchidectomy, aggravated his symptoms, and he went on rapidly from bad to worse. Even after the prolonged drainage, which I carried out faithfully, he had relapse after relapse, only relieved by a life in the open air, and, finally, a cure (?) achieved by a climate where life in the open air could be the rule and not the exception. I have repeated this observation so often in cases where the pain cannot be referred to a distinct ulceration or to some one of the tangible causes referred to, that I insist upon hygienic methods before resorting to surgical ones. To emphasize the effect of hygiene in a case subjected first to a surgical treatment, let me take another of similar import.

Case II.—J. K., aged thirty years; married; no children. Had an attack of gonorrhœa twelve or fourteen years ago. When he came under observation, on January 3, 1892, he stated that for over seven years he had suffered from dysuria, but was able to hold his urine about two hours, on the average. He had never passed any blood, excepting during his attack of gonorrhœa, and also after the passage of a sound, when he was told that he had a stricture. About two years ago a competent surgeon operated on him, attempting drainage by external urethrotomy, but he could bear the tube only twenty-four hours, and his symptoms were not relieved. His frequency gradually became worse, until he was obliged to urinate every fifteen or twenty minutes. This symptom was so severe that he was in the habit of sleeping on the floor, because he wet the bed so constantly. There was also great pain and tenesmus. Irrigation of the bladder with different solutions, applications of various kinds, and the iodoform treatment gave only slight relief, and even this was temporary. On February 9, 1892, I did a suprapubic cystotomy. No tumor nor ulceration was found, but the bladder walls were soft and intensely hyperæmic; so much so, that while filling the bladder with fluid preparatory to doing the operation, a slight rupture of its anterior wall occurred; this immediately closed and no serious consequences resulted. There was marked improvement after the drainage was instituted, especially as to the relief from pain. The patient left the hospital on April 4, still wearing a hard-rubber-plate, tube and bag, into which the urine drained continuously. On May 26, after sixteen weeks of drainage, the tube was removed. He was free from pain, but urinating every fifteen or twenty minutes till the end of June, when the pain at the end of micturition returned. All local treatment made him worse. He was as badly off as before, and suffered from great frequency and tenesmus. In September, 1892, he developed a subacute epididymitis on the left side. The following month the corresponding testicle began to swell and became very painful, and an abscess formed, which was evacuated and dressed with iodoform. In November of the same year he was advised to go to Southern California. He did so, and under date of July 10, 1893, he writes from there as follows : "While I am not entirely well, I have nothing to complain of and am in good health. My testicles are all healed up, and they appear to be as good as they ever were. I have no pain whatever on urinating ; still, I urinate every fifteen or twenty minutes. I am very strong and work every day."

It will be observed that this patient was of about the same age as the preceding one, and that the prominent symptoms were the pain, related to the act of urination, and the frequency, at first not oftener than once in two hours, but the intervals gradually shortening until the act was repeated every fifteen or twenty minutes. Also in his case bacteriological examinations, conducted most carefully in the laboratory, gave negative results until late in his history, when tubercle bacilli were found in the pus from his testicle. In his case there was no nodulation of the prostate or seminal vesicles, and no kidney lesion could be determined, but the clinical picture made my diagnosis of a tubercular process quite certain, and subsequently this was confirmed by the finding of Koch's bacilli. You will observe also that all local and surgical treatment was followed by no permanent benefit, and that although his residence in the same climate as the other patient relieved him from pain, there was still increased and abnormal function of the bladder. To illustrate the advantages to be derived from simple hygienic measures, permit me to report the following case:

Case III.—The patient was a young man, aged twenty-three years, who never had had gonorrhœa nor other venereal disease; he was a straightforward, manly, upright fellow, whose history and character were as clear as crystal. In January, 1893, he had what he called a bad cold, with fever, and on the second day after the fever he had pain in the perineum and a sudden discharge of pus and blood from the urethra, accompanied by severe pain. When he came under my observation in June of that year he had a subacute, purulent, urethral discharge; the urethra was very tender and the meatus swollen. There was no blood present, but he stated that once about every two weeks a little blood followed the act of urination. At that time the intervals of urination varied from every half hour to once in two hours. Per rectum, the prostate was slightly swollen and tender and at the base of one lobe it was distinctly nodulated. Bacteriological examinations of the urethral discharge proved negative as to tubercle bacilli, but the pus was very abundant. No cultures were made. There was a tubercular family history, and he stated that about two years prior to his present trouble he had had an operation performed on one foot for an open sore of some kind. He was unable to give any definite clinical history of this sore, but he stated he was a long time in recovering from the effects of the operation, the scar of which can be seen upon his foot, and has no characteristics by which to define its nature. In this case, in spite of the negative results of the examination, the diagnosis of the tubercular process seemed so positive that I insisted that he should go to the mountains, and remain there at least two years. He went to the Blue Ridge region of Pennsylvania, and from there to the Adirondacks, in New York, where he remained until the following autumn. He gained steadily in weight, his urethral discharge entirely disappeared, and his urinary intervals lengthened so that he urinated but once every three hours and once during the night. Believing himself to be well, he returned to the city and went back to his studies at college. In a short time, which was indefinitely stated, his symptoms began to get worse and he was brought to me again in April of the following year. Nocturnal urination had returned, he had a slight urethral discharge and the same burning pain which comes just as the stream of urine starts, and sometimes this is so severe as to induce a spasm which shuts off the flow of urine in mid-stream. The sensitive deep urethra was gently treated with iodoform, and again he was sent to the country, where he remained until December, 1894. He gained twenty-four pounds.

There were a few shreds or flakes in his urine, but he had no pain, no frequency of urination, and he considered himself tolerably well. I insisted upon prolonged residence out of the city, and my advice having been followed, he still remains well.

I have chosen these cases as typical of many. The patients were about the same age; the commencement in each case was about the same, and their course up to the time of beginning treatment was similar. In the last case, however, there was a minimum of instrumentation, which was done only for the purpose of relieving the acute symptoms. No surgical measure was instituted, and he was submitted to the curative influence of a hygienic mode of life,—a radical change from his usual existence. Vitalization of tissue is what these patients need, and they require at least two years of good hygienic residence in a temperate climate; but besides climate, they need occupation, for in my observation *ennui* seems to be almost as deteriorating as confinement to the house. Surgical traumatism, produced by over-zealous efforts to relieve local symptoms, seems to me to result in more harm than good. Such efforts are apt to put the unhappy patient still further below par, and facilitate the development of other tubercular foci either in the same organ or in one more distant. It is not necessary to enter into the question of whether the infection is an " ascending" or a " descending one." The phrase deceives us. The bacilli are in the individual's blood, and they only await a local congestion (following some form of irritation) in order to lodge and proliferate.

After faithful and zealous efforts to relieve by surgical interference the local symptoms of these cases, I have been forced to the conclusion that the less instrumentation we resort to, the better. In the genito-urinary tract, as in the tubercular process elsewhere, the best defence of the tissues against the inroads of the bacilli and that which finally effects a cure is to be attained only by enabling the body to surround the tubercular deposits with a layer of healthy connective tissue. It seems to me this can be done in no other way than by improving the quality and resisting power of the individual.

In strong contrast with the foregoing group, permit me to lay before you a class of cases very common, and in which the possibility of a cure also depends upon their early discovery. Unfortunately, in these cases, many of the early symptoms are overlooked, or, if appreciated, are misunderstood. The patients themselves, because of the insidious onset of the disease, become accustomed to their first symptoms and usually do not seek the advice of their medical attendant until the affection is well advanced.

I have chosen the three following cases, because each represents a distinct pathological condition, and their study, I believe, will prove to be instructive:

CASE I.—The first case is one of sarcoma of the bladder, with the following history: The patient was a well-preserved man, aged fifty-one years. In January, 1892, he began to have frequency of urination, say every two hours, without pain. At that time there was no change in the urine, excepting that at intervals of from three to six weeks the urine contained a moderate amount of blood. These paroxysms would last about three days, when the blood entirely disappeared. In May, 1893, for the first time he passed a small clot of blood, which came with the first gush of urine. Two or three days later he had chills, with a rise of temperature and increased frequency of urination,—that is to say, every half hour,—and for the first time he had pain before, during, and after each act of urination. The urine now contained pus and mucus and also blood without intermission, the latter persisting for several days. He evidently had an attack of cystitis, which came on without instrumentation, and an interesting query would be, How did pus microbes find access to this bladder? The blood and pus gradually decreased in quantity, but did not entirely disappear. Some improvement also took place in the intervals of urination, but towards the end of May he again had an attack of chills, with a rise of temperature to 102° F., and was confined to bed for about ten days. Again improvement gradually took place.

When he came under my observation, in July, 1893, he was urinating every two hours and pus and blood were still present. With the first flow of urine came a little gush of blood and clots of muco-pus. The whole volume of urine was tinged with blood, bright in color, and not smoky. An examination of the urethra was negative. Examination of the prostate showed some lateral and median enlargement. The prostatic urethra was extremely sensitive, and a search for stone or neoplasm was negative. It was impossible to cystoscope him without the aid of an anæsthetic, and this he declined. He also declined any exploratory operation, and he was temporized with until the following autumn, hot-water irrigations being used to check the hæmorrhage.

In November, 1893, he again came under my care, and an operation being consented to the bladder was opened by the suprapubic method without antecedent cystoscopy. The free blood, its bright color, its relation to the act of urination, the presence of clots and the history of cystitis, with the long-continued cycles of hæmorrhage made a diagnosis of neoplasm in the bladder extremely probable. When the bladder was opened and its interior explored, at first nothing was seen but the intensely hyperæmic mucous membrane. Apparently, the whole interior of the bladder was of this character, and no salient, projecting new growth of any kind was to be seen. Careful exploration with the finger, however, revealed a soft, flap-like body, growing from about two-thirds the circumference of the internal orifice of the urethra, hanging down over the latter and from which it could be partially lifted like a small curtain. It was disk-like, so that when looked at from above it appeared to be a continuation of the anterior mucous wall of the bladder, but when the bladder was distended by instruments, in order to bring into view the urethral orifice, it was seen that the latter was more or less obscured by this new growth. It bled on the least touch. It was friable, and was removed in piecemeal by means of the scissors, together with the underlying tissue wall of the bladder. Macroscopically, the nature of the growth could not be made out. The report from the laboratory regarding it is as follows: "It is unquestionably malignant,—probably carcinomatous,—but there is some question as to whether the cells are large, round sarcoma cells or epithelioma. Microscopically, the growth is very near the border line of carcinoma and sarcoma."

The immediate history of the patient after the operation was uneventful. Before the suprapubic sinus entirely healed there was a recurrence of the hæmorrhage, and the further progress of the case may be summed up in a few words. It was evident that there had been a rapid recurrence of the disease, but the man refused all further operative interference. The hæmorrhage and frequency persisted, and the pain necessitated the constant use of morphia. The patient died in October, 1894.

Here was a man with a disorder of the urinary apparatus, which he allowed to exist for over a year before seeking competent medical advice, and the strong presumption is that if a diagnosis could have been made at an early stage, a radical cure of the neoplasm could have been effected. In regard to this, however, I would be guarded in my statements, because we all know the tendency of such growths to recur, and the difficulty of entirely eradicating them, but I believe that in the bladder—as in the breast—primary, free excision, followed if necessary by secondary operations, gives us the best possible chance of effecting a permanent cure. I am aware of the difficulties that surround the early diagnosis of neoplasms of the bladder, but without doubt at an early stage he could have been cystoscoped, his condition recognized, and the progress of the disease retarded at least.

I might add that so much hæmorrhage from such a small growth is not uncommon. It sometimes seems as if a large part of the blood-current of the bladder wall were diverted by a neoplasm not larger than this one.

Case II.—This patient was a male, aged forty-two years. In May, 1890, he first noticed that he had to hurry when the desire came on to urinate. With that exception he had been perfectly well. The intervals of urination were not shortened. About this time he was married, and soon after he noticed a slight discharge of blood immediately after urination. This would occur about once a month, and was without pain. Gradually, the intervals of urination shortened, and the hæmorrhage increased and appeared more frequently. This went on until one year before coming under observation, when he began to get up once or twice at night to pass his urine. Four months later pain appeared for the first time, especially at the end of urinanation, and there was more blood in the urine, associated with great tenesmus. Clots also began to appear in his urine, and these since then have been constant. Another symptom gradually added was that when his bowels moved the tenesmus was increased, and at the end of the act of urination a drop of what he described as mucus appeared at the end of the penis.

When he first came under my observation the bladder was extremely irritable. It was incapable of holding more than three ounces of urine, and the whole volume of urine was stained with blood, bright in color, and at the end of each act of urination clear blood was squeezed out. The man was pale, thin, extremely cachectic, and very weak. It was impossible to cystoscope him without an anæsthetic, and inasmuch as the diagnosis of foreign body or new growth in the bladder was tolerably clear, I advised immediate operation. The suprapubic opening was accordingly made, and as the bladder wall was cut through, soft, spongy epithelial masses protruded from the opening. Examination with the exploring finger revealed that the bladder was (literally) filled with these epithelial, cauliflower-like outgrowths, and its small capacity was readily explained. They sprang from all sides of the bladder, as well as the base and fundus, and it was utterly impossible to remove them. The hæmorrhage was profuse. It seemed wise to give him the benefit, if any, of drainage, and further operation was decided against. The only benefit derived from the operation was relief from the frightful tenesmus and frequent urination. The patient died the following September. The report from the laboratory was as follows: "The specimen is typical of carcinoma, of squamous or epidermoidal type."

This case, when compared with the other, shows that the first symptom in both was frequent urination, without either pain or blood. In both cases, these latter symptoms appeared later. The condition of the bladder in these two cases was entirely different. In the first there was a small, flat, disk-like body, while in the second the cavity was almost filled with a mass of cauliflower-like growths. I believe that in the second case, as in the first, an early diagnosis might have offered a fair possibility of effecting a radical cure.

CASE III.—In this case the symptoms differed entirely from those in the two just narrated. The patient was a male, in apparent good health, who had a sudden attack of complete retention of urine lasting ten hours. This occurred one year before he came under my observation, which was in December, 1894. During his attack he had no medical attendance, and the retention, it seems, was relieved spontaneously, but subsequently he had to urinate every two hours, day and night. He had some pain, which he referred to the sacral region and attributed to rheumatism. In June, 1894, a little blood appeared in his urine on one occasion, but he could not tell what relation this had to the act of urination. In October, 1894, under the care of a doctor, a catheter was passed and three pints of residual urine were drawn; since then he has been regularly catheterized and washed. He cannot now, nor has he been able since then, to urinate spontaneously. There has been gradual emaciation, and the man is cachectic in the extreme. His urethra is narrowed to such a degree that only a No. 5 French catheter can be used. A bimanual examination shows that a neoplasm has converted the prostate and base of bladder into a large, hard, irregular, insensitive mass. It occupies the whole inferior segment of the pelvis, extending laterally, upward and backward, as far as can be reached. The prostatic portion of the urethra is evidently encroached upon and its calibre reduced, but the bladder retains a satisfactory capacity. The inguinal glands on both sides are hard and double their normal size.

It is plain that here is an entirely different pathological condition from the others which I have reported. This case differs in the insidious character of its onset, and its rapid progress, less than one year having elapsed, so far as we know, since the first manifestations of the presence of the growth,—namely, the sacral pain and the retention of urine. Palpation shows the growth to be scirrhus in nature, making the diagnosis tolerably certain. This man has had no pain, excepting that referred to in the sacral region. He has had no hæmorrhage, and yet the neoplasm has existed long enough to become generalized, for the man is dying of cachexia.

I have contrasted these two groups in order to present for your discussion the points,—

(1) That incipient cases of tubercular origin should be subjected to hygiene rather than to surgery; and,

(2) That in the incipient stages of neoplasms surgical procedures of the most radical kind should be instituted.

# A CONTRIBUTION TO THE SURGERY OF THE HYPERTROPHIED PROSTATE.[1]

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WITH our present experience in the surgery of the hypertrophied prostate, and with the imperfect results hitherto so often attained even after serious operations, any additional clinical facts are of importance. Interest in this subject has been revived since, through the experiments and observations of Professor White, of Philadelphia, the operation of castration has been brought prominently before the profession, and been backed by a sufficient number of successful reports to warrant even the most conservative surgeons in advising it in selected cases.

Most of the operations proposed have met with some share of success, but the average mortality from the more radical measures has been too heavy to make their general adoption advisable.

The simplest and safest of these, perineal section, incision well into the median portion of the prostate, separation of the edges of the prostatic incision as widely as possible by firm pressure with the finger, forceps, or divulsor, and the retention for two or more weeks of as large a catheter as could be tolerated, has given me many excellent results, especially when the hypertrophy was chiefly confined to the median portion. By excellent results I mean diminution or relief of pain and straining, increased size of the stream with diminished frequency of urination, and lessened residual urine or its complete disappearance. Unfortunately relief so afforded is not always permanent. In the case longest under my own constant observation, now over three years, the amount of residual urine, which before operation was twenty-two ounces, and decreased after operation to five ounces, is now slowly increasing, so that frequently eight and sometimes nine ounces are withdrawn. This patient, however, is still able to introduce a soft catheter with ease, which he does once daily, a thing impossible for him prior to operation. The lateral lobes have increased in size, and there is an occasional return of frequent urination, but otherwise he remains comfortable and free from the marked and painful straining and disturbed rest from which he suffered so much prior to prostatotomy.

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[1] Read before the Brooklyn Surgical Society, May 2, 1895.

The most marked result from this operation was in a patient whose age was only fifty-six, and yet he had been troubled for four or five years with symptoms referable only to an hypertrophied prostate. He had during this time complained of frequent urination, especially at night, diminished size and force of stream, occasional retention for part of a day, etc. There was no antecedent history of venereal disease, and no stricture of the urethra. When first seen he had been suffering from retention, with some overflow for two days. Two quarts of foul ammoniacal urine were removed. There was moderate enlargement of the lateral lobes of this man's prostate, and decided enlargement of the median portion, as shown by the sound and cystoscope. After four weeks' treatment by frequent catheterization, tonics, etc., and after several days of constant drainage by a retained catheter, there was still almost complete inability to void urine. At times, with much straining, he would pass a few drachms, more often none. After the perineal operation and two weeks' drainage this patient regained the power of voluntary urination and gradually improved, and residual urine disappeared. His condition remained the same for four months, since which time I have been unable to trace him.

In a total of eleven cases operated on by this method there has been more or less marked improvement in all and no deaths.

Where it is deemed advisable to remove any portion of the prostate, I believe it should always be approached by the suprapubic route. Efforts at complete removal of the median portion by the perineal route alone are unsatisfactory and dangerous, for while incision can be made under guidance of the finger where the perineal distance is not too great, the finger and the rongeur or any other instrument devised for perineal prostatectomy cannot occupy the neck of the bladder at the same time, and the surgeon can neither feel nor see the extent of his work, and is in no position to deal with the hæmorrhage which is certain to be more profuse than that which results from incision and stretching. In two of the foregoing cases I tried to remove some of the median enlargement in this way, and partially succeeded, but the final result was no better than after incision and stretching, and the convalescence more tedious. Whether the perineum is to be opened subsequently to suprapubic incision for better access to the prostatic urethra, drainage, etc., must depend on the case.

Although I have had no deaths from suprapubic prostatectomy in the three cases so operated upon, the results have not been very encouraging. In the first two cases, although the patients were able to introduce the catheter with ease, where before it had been very difficult, power of voluntary urination was not restored except to the extent of a half ounce or so at a time, and this only when the bladder was over-distended. In the third case I removed a stone and the median portion of the prostate nearly four months ago. This patient was sixty-four years of age, had been suffering greatly for a long time, and had chronic interstitial nephritis. The suprapubic operation was necessitated on account of the size of the stone and prostate. The median portion of the prostate formed a complete valve, and so effectually closed the vesical outlet that the latter could not with certainty be identified until a sound was passed per urethram. Pushing the portion to be removed backward by means of a large sound so introduced, greatly facilitated the operation. Cutting was continued until a deep groove marked the former site of the hypertrophy, and a short beaked sound easily entered the bladder. The highest temperature, after operation, in this case was 102.2° F. Normal after the third day, except on one occasion, when it rose to 100° F. The drainage-tubes were removed, one on the seventh and one on the fourteenth day. The abdominal wound had closed at the end of the sixth week. Four weeks later, and five weeks after the patient had been up and around, he complained of pain in the perineum, and in a few days I opened an abscess, through which afterwards there was a leakage of urine. While in bed, from this complication, the abdominal wound reopened. He has been able to pass a little urine voluntarily, but as yet not over an ounce or two at a time. For two years prior to operation he depended entirely upon the catheter, never voiding a drop without its aid. At present writing the abdominal wound has closed again, the perineal fistula nearly closed, and he thinks he could pass considerable urine voluntarily were it not for his fear of forcing it through the perineal opening. His urine remains clear, he uses the catheter every three or four hours and feels confident of still further improvement. In all of these cases the continued inability to void urine, in any quantity, I believe to be due more to atonied bladders than to obstruction of the vesical outlet.

*Castration for Hypertrophied Prostate.*—The two cases upon which I have performed castration for the relief of this disease are herewith reported.

Case I.—The patient was fifty-eight years of age, and gave a history of having had more or less difficulty in urinating for ten or twelve years. Thirty-five years ago he had a single attack of gonorrhœa of moderate severity and short duration. During the last few years he has been under treatment in several different hospitals, in all of which he has been told that his trouble was due to enlarged prostate. For several years he has had more or less incontinence, which has been growing more rapidly worse of late, so that for the past two years the dribbling of urine has been so nearly constant that he has been prevented from doing any active work. Five and a half ounces of residual urine was present at the first catheterization. His general condition was bad, and there were evidences of degenerative changes in his vascular system. No previous treatment has, he claims, given him any permanent, generally not even temporary, relief.

Great difficulty was experienced in catheterization owing to obstruction in the prostatic urethra. Nothing, as a rule, but a long, curved, silver catheter could be introduced. Length of urethra about eight and a half inches. There was a stricture of large calibre in the penile urethra, and one at the bulbo-membranous junction, but it did not seem that these were responsible for any of his symptoms. Thompson's searcher could not be passed owing to the size of the median portion of the prostate, but a small Van Buren sound was introduced with difficulty by greatly depressing its shaft and using some force to override the obstruction. Lateral lobes only moderately enlarged, the right a little more than the left.

Castration was proposed to this patient as a possible means of relief, and accepted. Both testicles were removed February 24, 1895.

He had been suffering from some catheter fever prior to operation. Highest temperature after operation 101.4° F. Normal after the third day. The catheter was passed every four or five hours to prevent soiling of the dressings. The house surgeon found catheterization more easy each day, and soon was able to use a soft rubber instrument. There was no pain whatever as a result of operation. The second day after operation he voided twelve ounces of urine voluntarily, at different times during the day, and while there was no noticeable increase in the volume of the stream there was a marked diminution in the straining to which he had been so long subject.

The third night after operation catheterization was neglected, and he had some overflow. The following morning eight ounces were withdrawn and during that day he passed it without assistance. Six days after operation the amount of residual urine had fallen to a half ounce. The day following there was none. At times, however, during the following week there would be more or less residual urine present.

March 17. For the first time appreciable diminution in the size of the lateral lobes was noted, but that of the median portion was most marked, a sound passing into the bladder as though the former obstruction had been largely removed. After going several days without catheterization, five ounces of residual urine were found, showing an atonied bladder.

April 5. Continuous improvement in his local symptoms noted. He feels as if his urine passed naturally and has no straining whatever. Residual urine is generally absent or present only in small amount,—an ounce or less. He has, however, considerable of his former inability to retain urine when once the desire comes to void it. The interval between the acts of urination is growing longer, two hours, and at times three. Length of urethra now seven and a half inches. Prostate, as felt per rectum, much smaller, and a small-sized sound drops into the bladder by its own weight.

Case II.—The patient, who was sixty-nine years of age, was referred to me in January, 1895, by Dr. R. L. Dickinson.

For nine years this man had been troubled with frequent urination, associated with straining and pain during the act. For the past two or three years he has, for much of the time, urinated every half-hour at night and hourly during the day. Exceptionally he would not be disturbed for two or three hours. Straining during urination has been constant, and has become progressively worse. He has never had retention of urine, and gives no history of venereal disease. For the past year he has been losing weight, and has suffered much from loss of sleep. Sexual desire has been practically abolished for some time.

The length of the urethra was eight inches, and the bladder contained four ounces of residual urine. There was moderate enlargement of the median portion of the prostate, and the lateral lobes were at least double their normal size and symmetrical in outline.

During the four months following this date there was at times some improvement, but it would be temporary. The quantity of residual urine was at times six and seven ounces, and on the whole he had become so much worse that he asked for relief by surgical means. During the week immediately preceding operation he suffered greatly from frequent and painful urination, some nights every fifteen to twenty minutes. This with the consequent loss of rest were the only apparent causes for his elevation of temperature, which ranged from 100° to 101° F. for three days prior to operation.

The urine in this case was always acid in reaction, and contained only a small amount of pus.

May 18, 1895. I removed both testicles, which were far advanced in cystic degeneration. Neither shock nor pain followed. His temperature fell the next day to 99.4° F., and was normal after the third day.

May 19. At 8.30 A.M. he passed four and a half ounces of urine; about the same amount at 10 and at 11. After this last micturition there was found to be three ounces of residual urine.

During the four following days he continued to urinate with less pain and at from one to three hours' interval.

May 23. At 7 A.M. he passed voluntarily five ounces of urine; at 10.30 A.M., seven ounces; at 1 P.M., five ounces; at 3 P.M., seven ounces. At this hour three ounces of residual urine were drawn. His bladder was emptied by catheter at 10 P.M., and he urinated only once between this time and 5 A.M. the following day.

May 26, the eighth day after operation, the following notes were made: The patient has improved greatly in his appearance and looks less careworn. He can see no change in the volume or force of the stream, but the straining in voiding urine has diminished more than one-half. Last night at 10, three ounces of residual urine were withdrawn, and he slept till 3 A.M.—five hours—before he was called upon to urinate. He slept two hours more before he again had to pass water. There is no change in the length of the urethra, but examination per rectum shows marked diminution in the size of the right lobe and appreciable decrease in the left.

At this writing, eleven days after operation, the following bedside notes were made by the attendant: The catheter was passed at 11 last night, and two and a half ounces of residual urine were withdrawn. The patient did not pass water until 5 this morning—a period of six hours—and not again until 9.20. During the day, when drinking freely, he urinates every two to three hours. The decreased size of the prostate at so early a date was a surprise, and the inequality of the two lateral lobes still more so. I am quite sure that such a condition did not exist prior to operation, for I made several careful rectal examinations. Whether the fact that the right testicle was less far advanced in cystic degeneration than the left had anything to do with the result or not I do not know; but it seems possible that the most rapid change in the prostate might take place on the side of the gland that had been the most active.

No further comment is required on the improved condition of this patient at the present time. The facts as stated speak for themselves.

A few years ago a gentleman of sixty-five came under my care, whose testicles had been removed some months before for tuberculosis. At the time of my first examination there was a slightly nodular prostate, but no general enlargement of the lateral lobes, and no evidence of hypertrophy of the median portion. The urethra was not lengthened, and there was no residual urine. He had frequent and painful urination, and later on tubercle bacilli were found in abundance. At that time he made the statement, the significance of which I did not then understand, that after removal of his testicles he had much less difficulty in voiding urine than formerly. Not thinking of any possible effect on his prostate from castration, no further symptoms were noted; but the small size of the gland, though tubercular, and his statement in regard to urination coupled with his age were significant facts. This man lived nearly four years after he became my patient, and then died from tuberculosis of the bladder and kidneys; but his prostate never increased perceptibly in size, and he was never the subject of residual urine. This absence of prostatic hypertrophy may have been accidental, but in a uro-genital tuberculosis, beginning in the testes, and, finally, involving almost the entire urinary tract, we would expect marked enlargement of the prostate from tubercular deposits, especially when small foci undoubtedly existed in that gland. If castration can cause atrophy of the normal and of the hypertrophied prostate, there is no good reason why the same operation may not so affect its nutrition as to retard the advance of the tubercular process in its tissue. I mention this case, however, not for the purpose of suggesting castration as a remedy for tuberculosis of the prostate, unless perchance the infection were confined entirely to that gland, but because it is in direct line with this subject, and therefore of interest.

There seems to be sufficient evidence already before the profession to show that castration has a positive effect in reducing the size of the hypertrophied prostate; but in long-continued cases, in which atony of the bladder or other structural changes have occurred, we must be cautious in our prognosis lest we bring the operation into disfavor. It has occurred to me that some of the immediate results reported as due to castration might very properly be ascribed, in part at least, to the diminished congestion of the prostate and vesical neck following rest in bed and the maintenance of an even temperature of the body. We frequently see retention of urine from exposure to cold, even in prostatics, relieved by a hot bath. We often see painful and frequent urination promptly relieved by a few days' rest in bed, and a properly-directed diet and course of medication. In the case here reported, however, the effect upon the prostate was remarkable, and this was verified by a number of examinations both by myself and by my colleague, Dr. A. T. Bristow.

To obtain the best results from any operation for the relief of this disease, it should be performed before the bladder has undergone irremediable changes; and to persuade patients to submit to castration while yet their symptoms are of moderate severity will be a difficult matter. This operation will have to produce most decided and beneficial results before it can attain any degree of popularity. Removal of a portion of the vasa deferentia, which has been suggested in lieu of castration, would, perhaps, more readily be accepted by patients, but, from observation of a number of cases in whom the epididymis and vas have been obstructed permanently by repeated attacks of inflammation, I do not believe that such a procedure will prove useful.

What may be the condition, six months or a year hence, of those patients who have recently been subjected to castration in this and other countries, will be awaited by the profession with much interest.

# THE TREATMENT OF POSTURAL DEFORMITIES OF THE TRUNK BY MEANS OF RAPID AND THOROUGH PHYSICAL DEVELOPMENT.[1]

By JACOB TESCHNER, M.D.,

OF NEW YORK.

THE generally unsatisfactory results which have been attained by the different methods in vogue of treatment of the postural deformities of the trunk—viz., round shoulders, round back, hollow chest, pigeon breast, one-sided deformity of the costal cartilages, stoop shoulders, antero-posterior curvature, and rotary-lateral curvature—have led me, at the suggestion of Dr. Virgil P. Gibney, to lay before this section my theoretical deductions, which, practically applied, have resulted in a rapid improvement, and, in several cases, a complete cure.

I start from the stand-point that all of these deformities which may arise primarily from any of the following causes—viz., pleurisy with adhesions, empyema, section of the ribs, paralyses from different causes, rickets, irregularities of the extremities, faulty attitudes, neuroses, etc.—are permitted to develop only by weakened or rudimentary conditions of the muscular systems generally, or of certain muscular groups in particular.

There must be, to the knowledge of every one present, a vast number of cases where some one or more of these primary causes exist, and in which the muscular systems were sufficiently strong and active to overcome any tendency to the improper development of the trunk.

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[1] Read before the Orthopædic Section of the New York Academy of Medicine, May 17, 1895.

Assuming the theory advanced to be correct, it would be only a logical sequence to thoroughly develop and educate the general muscular systems, not only in those cases where the tendencies to deformities are known to exist, but also where deformities, whether habitual or fixed, are present, so that they may be cured, improved, or prevented from becoming worse.

All orthopædists are agreed that exercises, when properly given, are beneficial, but the degree of benefit must necessarily depend upon the muscular ability and the strength and the will of the individual patient to correct, or to partially correct, a faulty attitude or a deformity.

In considering the question of muscular development, I wish to state that I have renounced and discontinued all supporting and immobilizing appliances, as described in my paper,[1] in any and all cases which I consider amenable to treatment.

The objection to all supporting appliances is that each and every one will, to a greater or less extent, interfere with the mobility of the spine, and in that manner deprive the back, chest, and abdominal muscles of that perfect freedom of action which is a necessary and powerful adjunct in the successful treatment by gymnastics. In the treatment of deformities, the aim is and has been to correct the deviations from the normal by such exercises as will educate the different groups of muscles to sufficient and proper exertion, to enable the patient to assume as nearly as possible a normal attitude. This muscular education is dependent upon strength and development, without both of which we must largely fail to obtain that proper and vigorous muscular action upon which any beneficial results from corrective exercises must depend. Therefore, it is necessary and imperative, in all cases which require or are amenable to treatment, to attain the highest type of development possible of the entire body, to render the spine mobile in all directions, and also to develop the full strength of each patient. Individual work only can accomplish this end, because it is of the highest importance to carefully watch every

[1] Observations on the Rotary-Lateral Curvature of the Spine, with Special Reference to the Etiology and Treatment, read before the Surgical Section of the Pan-American Medical Congress at Washington, D. C., September 5, 1893.

movement of the patient and to immediately correct any and all errors in attitude, deportment, or exercise.

Before describing the system which I employ in the development of muscle and the attainment of strength, I wish to especially advise against the gymnasium training of any patient afflicted with any deformity or a tendency to one. There is no doubt that very many of those who regularly attend gymnasium classes do develop in physique, but I claim that only those few who are muscularly apt will, after long training, show a fairly good general development. The fault lies in the class training, in the general exercises, and in the uninstructed use of the different apparatuses. Feats of different kinds are attempted and accomplished, but the manner and means employed, whether awkward or otherwise faulty, count for nothing and are rarely corrected. I will show these statements to be facts. I will present a male patient to you this evening, who has attended one of the Y. M. C. A. gymnasia of this city for about two years prior to February 17 last.[1] He is now fifteen years old, has always been perfectly well, but considerably undersized. Prior to his work in the gymnasium he attended a military school, and I am told that his deportment and carriage were always good. It was only recently that the observant instructor at the gymnasium which he attended noticed a slight curvature of the spine of this boy and called his attention to that fact. The patient in turn informed his parents, who brought him to my office for my opinion and advice. I found a slight lower dorsal curve of the spine, the angle of the right scapula more prominent than the left, the left shoulder higher than the right, the ilio-costal curve greater on the right side than on the left, the shoulders drooping and falling forward, the right more than the left, and the linea alba deviating below to the right. The pectoral and abdominal muscles were very much better developed on the right side, and the back muscles on the left. The arms presented a striking appearance; the biceps muscles of both arms, the right larger than the left, were developed out of all proportion to the other muscles of the arm and forearm, causing both forearms to be slightly flexed upon the arms when in repose.

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[1] See Case VIII.

Full extension of the forearms, especially above the head, required considerable of an effort, showing that the overworked biceps and the undeveloped extensors produced the condition known as "muscle-bound." The patient was requested to demonstrate how he used the dumb-bells and Indian clubs in his class exercises. The movements were very rapid, inaccurate, jerky, without rhythm, and violent; so violent in fact that his entire body received a thorough shaking up with every movement of the upper extremities. A lack of control for fixation of the muscles of the neck, trunk, and lower extremities was evident.

The patient was requested to stand erect, the heels together, the toes apart, holding the chest high, the shoulders back, the abdomen retracted, the lower extremities fully extended, the arms downward close to the side of the body, and the forearms pronated, holding a two-pound dumb-bell in each hand. He was then told to flex the forearms alternately upon the arms to the shoulders, the elbows remaining immovable, close to the sides of the body, and the forearms remaining pronated. This the patient could not accomplish, because he could not, even with the greatest effort, control the pronators and the flexors at the same time. In endeavoring to flex them he invariably supinated the forearms to enable him to do so, and even then he wriggled his entire body, his shoulders dropped forward, the abdomen became prominent, his knees were flexed, and his feet shifted. His attitude, muscular condition, and inability to exercise properly and correctly fully demonstrated to me his faulty gymnasium training. When treatment, which was advised, was commenced, it was found more difficult to teach him and to correct his faults than any other patient who came under my care. But when he grasped the separate exercises and was able to execute them with grace and ease, very rapid improvement in his carriage was evident to his parents, to myself, and to others with whom he came in contact. The actual general changes in this patient you will notice in his chart.

Before treatment is begun the patients are weighed and measured, and the different strength tests are applied. All these data are recorded upon the anthropological charts, as devised by

Dr. Sargent, of the Heminway Gymnasium, at Cambridge, Mass. Photographs are also taken, if convenient, or if there be sufficient actual deformity to show in a picture.

The important points to be observed in the development of strength and muscle are correct attitude, ease and grace and rhythm of motion, and automatic and independent and full action of only those groups of muscles which are called into play by the performance of each separate exercise, and each group of muscles automatically exercised until it is thoroughly tired. No muscle can be properly developed unless it is tired by frequent and uninterrupted automatic contractions and relaxations.

All exercises with light weights should be executed in a closely-fitting jersey suit, before a mirror, so that the patients can hold themselves in the proper position while going through the different movements. By doing this they can see when the position is faulty, either by reason of a sagging of the trunk or through the lack of co-ordination of all those muscles which are to remain fixed while certain groups are in action, and they can correct their faults. It also materially assists in the acquisition of grace and ease in working automatically. Exercise in this manner brings about a forced and habitual corrected pose and carriage, while the strength and muscles necessary to maintain a correct position are being developed. Taking the stand-point that,—

(1) Lack of strength and lack of muscular development;

(2) Habitual faulty position with superimposed weight; and,

(3) Lack of co-ordinating power or lack of muscular control, are the more potent etiological factors in producing deformities, it is and has been my aim—and I believe that I have succeeded—in correcting deformities by reversing these conditions, —that is,

(1) By developing the muscles and their strength;

(2) By acquiring an habitually corrected position with superimposed weight; and,

(3) By educating all the muscles to proper co-ordination and to complete control.

A pair of dumb-bells, weighing from one-half to five pounds each, according to the ability of the patient, is used in a series of twenty-six exercises.

I would state here that this method is a systematic classification of the work employed by that renowned German athlete and strong man, Louis Attilla, the trainer of "strong men," who by his instruction is reputed to be responsible for the successes of many athletic celebrities, including Sandow.

*The Exercises.*—The patient stands erect, the heels together, the toes apart, the knees thoroughly extended, the abdomen retracted, the chest high, the head well poised, and the patient looking intently and sharply into his or her own eyes in the mirror, the lips being evenly, but not too firmly, closed, and the facial muscles in repose. The patient should breathe easily and regularly while exercising. (Figs. A and 1a.)

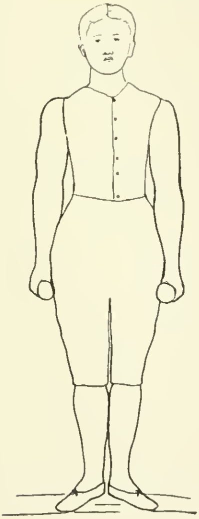


FIG. A.

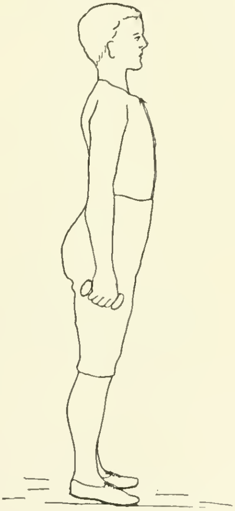


FIG. 1a.

(1) The upper extremities are fully extended downward, the forearms supinated, the elbows remaining close to the sides of the body, and the upper arms being fixed; the forearms are alternately and automatically fully flexed and extended, the wrists and entire body being fixed and immovable. Twenty to fifty times. (Fig. 1.)

(2) The same position and exercise, except that the forearms are fully pronated, and remain so during alternate flexion and extension. Twenty to fifty times. (Fig. 2.)

(3) Both bells over the shoulders, the arms abducted at right angles to the body and in the same vertical and horizontal planes, the forearms fully flexed upon the arms, and the wrists fully flexed upon the forearms. The forearms and wrists are then alternately and automatically extended and flexed. Ten to twenty times. (Fig. 3.)

(4) The same position and exercise, except that both upper extremities are flexed and extended at the same time. Five to fifteen times. (Fig. 4.)

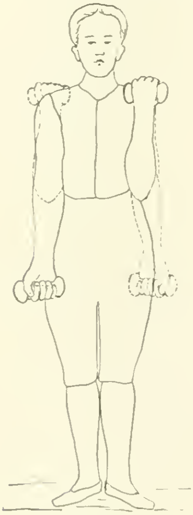


FIG. 1.

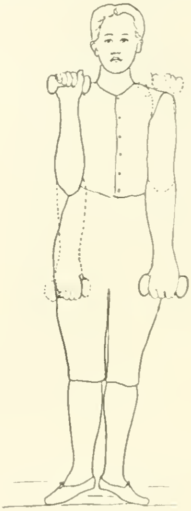


FIG. 2.

(5) Both upper extremities fully extended forward on a level with the shoulders, the dorsum of the hands outward. They are then fully and forcibly abducted on an horizontal plane, raising the patient's body upon the toes, and then permitted to recede to the original position, the body resting on the toes and heels, the elbows and wrists still rigid, and the bells not being permitted to touch as they approximate each other. Five to ten times. (Figs. 5a and 5b.)

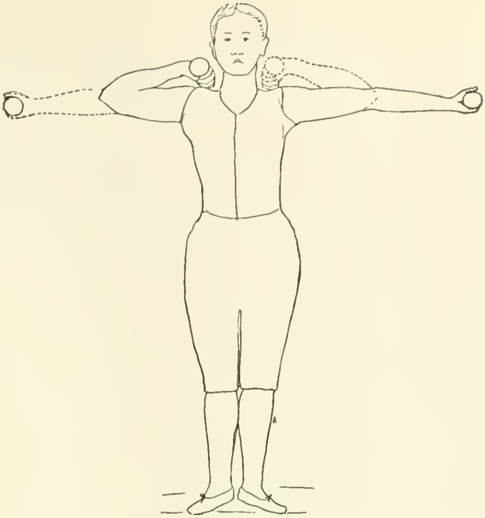


FIG. 3.

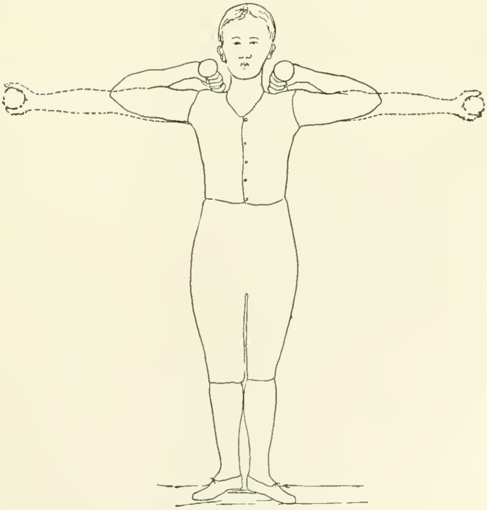


FIG. 4.

(6) Bells in the position of exercises No. 3 and No. 4. The arms are fully extended alternately above the head. Ten to twenty times. (Fig. 6.)

(7) Bells in front of the thighs, forearms pronated, and bells

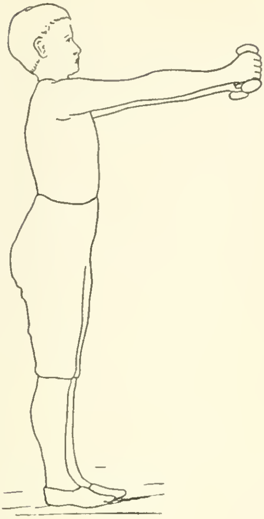


FIG. 5a.

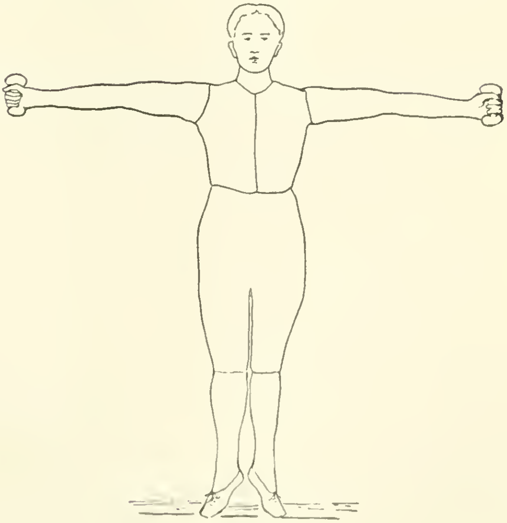


FIG. 5b.

alternately raised to the level of the shoulders, the elbows and wrists being fixed. Ten to twenty times. (Fig. 7.)

(8) The arms abducted at right angles to the body, the bells rotated rapidly and forcibly forward and backward, the elbows being fixed. Five to ten times. (Fig. 8.)

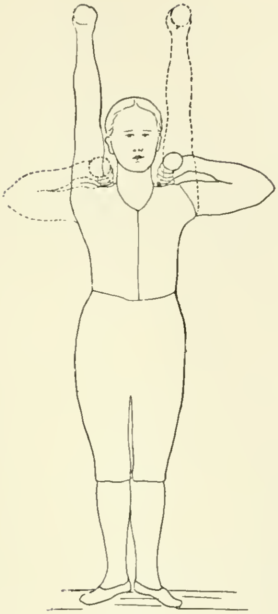


FIG. 6.

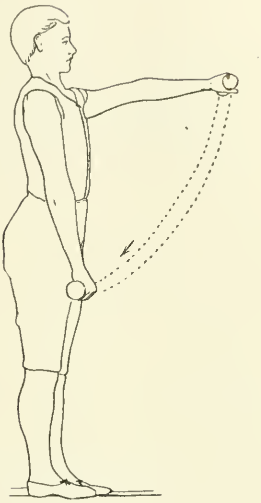


FIG. 7.

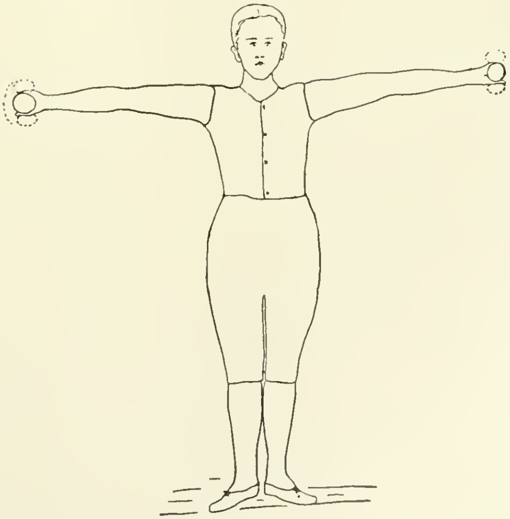
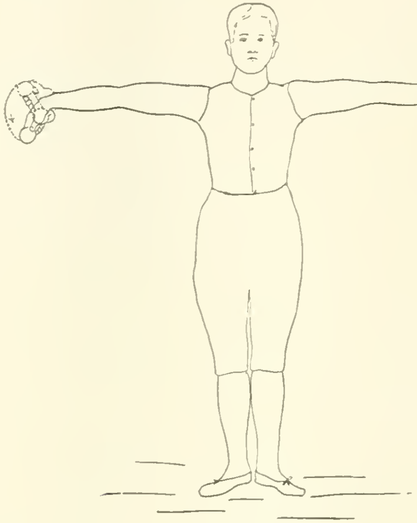


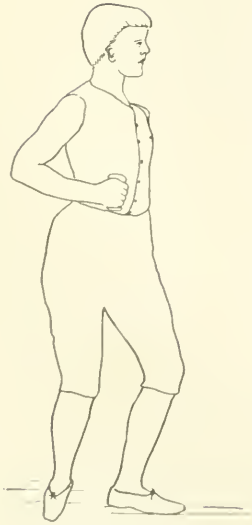
FIG. 8.

(9) The arms abducted at right angles to the body, the thumbs upon one ball of each bell, the hands circumducted for-

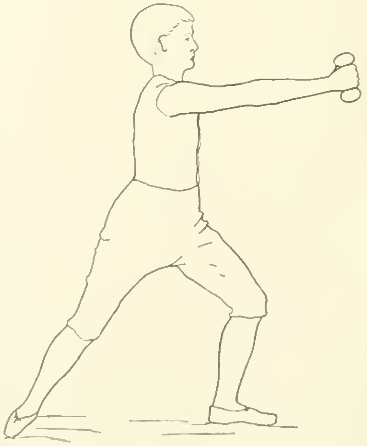
ward from above downward, the ball upon which the thumbs rest describing circles, the elbows and shoulders being fixed. Five to ten times. (Fig. 9.)



FIGS. 9 and 10.



FIGS. 11 and 12a.



FIGS. 11 and 12b.

(10) The same as No. 9, the hands being circumducted backward. Five to ten times. (Fig. 10.)

(11) The bells to the side. Right face upon left heel, then placing the left foot at right angles to right foot opposite the arch, the knees slightly flexed, the right hand at waist-line against the body, the bell being perpendicular. Second part of motion: strike from the shoulder to level of the face, advancing a step upon the left foot, rapidly extending the right thigh and leg, the right foot being fixed upon the floor, and quickly back to position. Ten to fifteen times. (Figs. 11 and 12a and 11 and 12b.)

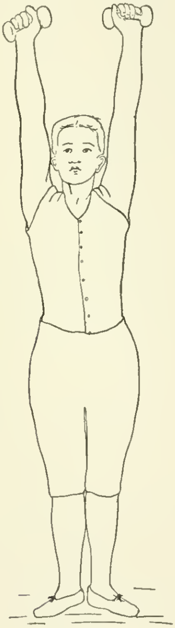


FIG. 13a.

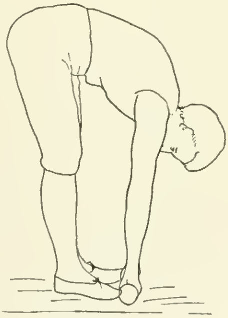


FIG. 13b.

(12) Exactly the reverse of No. 11. Ten to fifteen times. Figs. 11 and 12a and 11 and 12b.)

(13) Bells extending above the head, palmar surfaces looking forward, bending down to the floor, the knees remaining extended, and return. Five to fifteen times. (Figs. 13a and 13b.)

(14) Bells downward at the sides, raising and dropping the shoulders. Ten to twenty times. (Fig. 14.)

(15) Bells downward at the sides, flexing the spine laterally,

first to the right and then to the left. Ten to twenty times. (Fig. 15.)

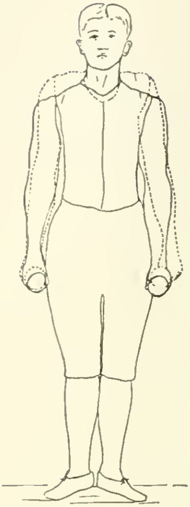


FIG. 14.

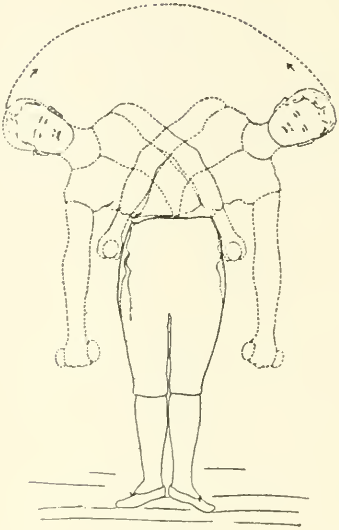


FIG. 15.

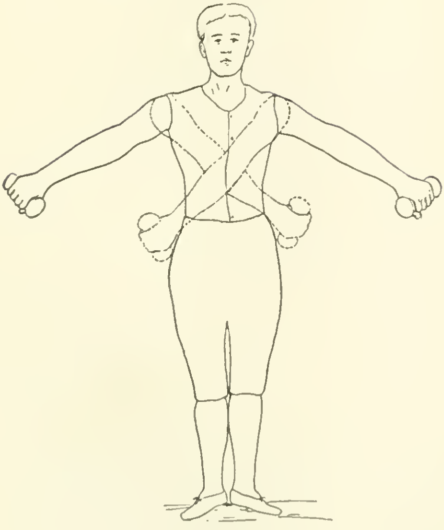


FIG. 16.

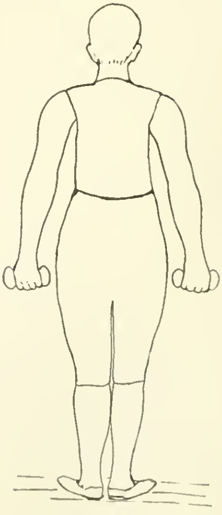


FIG. 17a.

(16) Both arms extended forward about forty-five degrees and abducted at about the same angle, then forcibly crossed in

front of the chest, causing the pectoral muscles to contract vigorously, the elbows and wrists being fixed, and then back to the original position, Five to twenty times, alternating the right and left hands above. (Fig. 16.)

(17) Bells at the sides, palmar surfaces looking forward. Extend arms backward in a vertical plane as forcibly as possible, holding them rigid in the fully extended position for a few moments, and then returning the bells to the sides. Five to fifteen times. (Figs. 17a and 17b.)

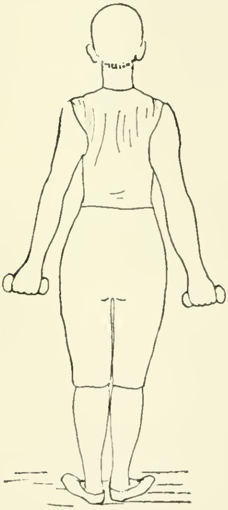


FIG. 17b.

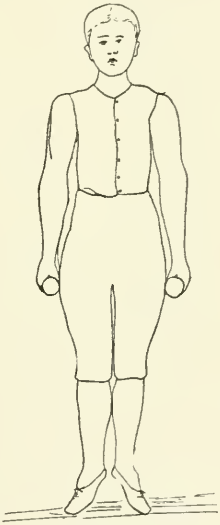


FIG. 18.

(18) Bells to the sides. Raise the body upon the toes and backward to original position. Ten to twenty times. (Fig. 18.)

(19) Same position. Raise the toes as far as possible from the floor, the body remaining erect. Ten to twenty times. (Fig. 19.)

(20) Same position. The patient squats, abducting the knees and resting upon the toes, the heels being raised, the trunk perfectly erect, then resuming first position. Five to twenty times. (Fig. 20.)

(21) Same position. Standing upon left foot. Flexing the right thigh at a right angle to the body, extending the knee and

ankle fully. The patient squats on the left ham, the left heel remaining upon the floor, and then resumes the first position. Two to five times. (Figs. 21 and 22.

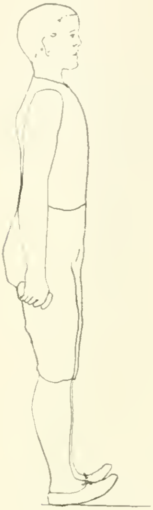


FIG. 19.

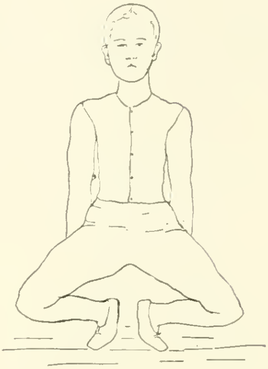
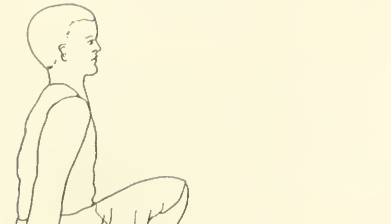


FIG. 20.



FIGS. 21 and 22.

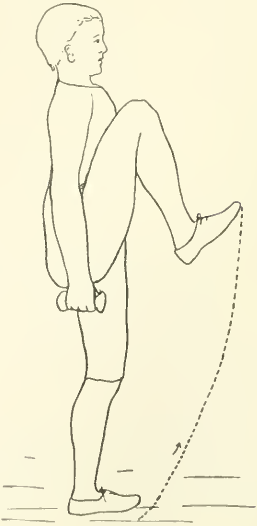


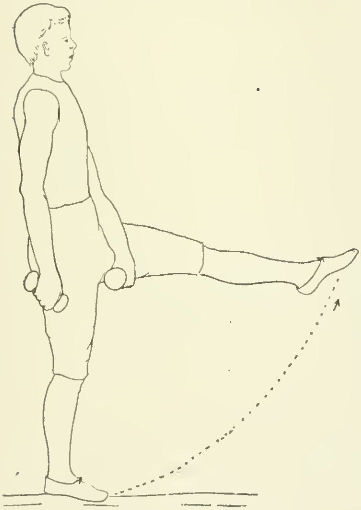
FIG. 23.

(22) The same, standing upon the right foot. Two to five times. (Figs. 21 and 22.)

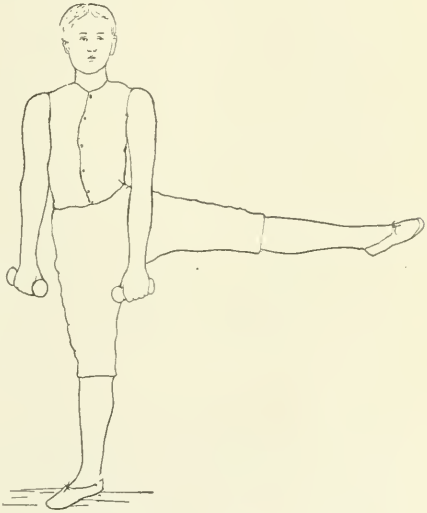
(23) The same position. Alternately and forcibly flexing the thighs and legs, causing the knees to touch the shoulders. Ten to twenty times. (Fig. 23.)

(24) The same position as in No. 21, extending the right lower extremity, the right bell inside the thigh, the right foot moved in a circle on an horizontal plane to complete extension backward, and resuming the first position. Two to five times. (Figs. 24 and 25a, 24 and 25b, and 24 and 25c.)

(25) The same as No. 24, standing upon the right foot. Two to five times. (Figs. 24 and 25a, 24 and 25b, and 24 and 25c.)



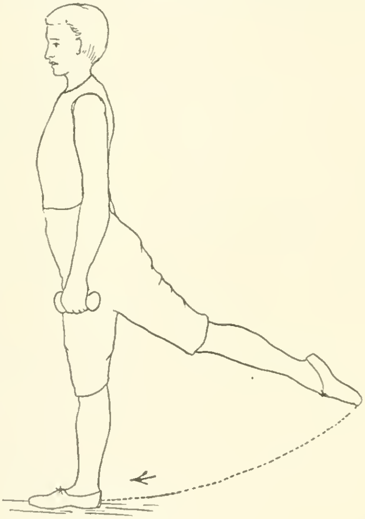
FIGS. 24 and 25a.



FIGS. 24 and 25b.

(26) The patient lying supine upon the floor, the lower extremities fully extended, the bells resting upon the chest, then raising the trunk to the sitting position, the lower extremities remaining extended, and the eyes being fixed upon the ceiling, and returning to the original position. Five to twenty times. (Fig. 26.)

When the patient is proficient in these exercises, they should be done at home every morning and evening. In addition to these development exercises, I give the patients work with heavy bars and dumb-bells at each visit to my office. The weight of the bars and bells, the number of times that each heavy weight or pair of weights is handled, and the frequency of the patients' visits depend upon the strength, capacity, and upon the endurance of the individual. It has been my practice to put each patient to his or her individual limit of work at each *séance*, and that limit is invariably extended at each succeeding *séance*, unless the patient is indisposed. The strength and endurance, as shown by the amount of weight handled and the number of times each weight and set of weights is handled, increases very markedly in every case from one visit to another. This increase is largely dependent upon correctness of posture and precision in the work. This is a matter of record in all my cases, as I keep a tabulated statement of all the work, designating the weights used, and the exact number of times each exercise has been performed. In reporting my cases, I shall, as an illustration, append the record of work in one case (Case IX). Bells weighing from five to forty pounds each and steel bars weighing from twenty-six to seventy-eight pounds are used in different ways. Bells are pushed from the shoulder above the head alternately, as often as the patient can.



FIGS. 24 and 25C.

The patient is instructed to swing a heavy bell with one hand from the floor, above the head and down again, the elbow and wrist being fixed and the motion repeated as often as possible in a systematic manner; then with the other hand, the same number of times; and later with both. This exerts all the extensor muscles from the toes to the head in rapid succession.

When a heavy bell is pushed or swung above the head on the side opposite the scoliosis, the action of the back muscles, to sustain the weight and equilibrium, is such as to cause the curved spine to approximate a straight line. A similar result is produced when a heavy weight is held by the side of the erect body on the scoliotic side, the arm being at full length.

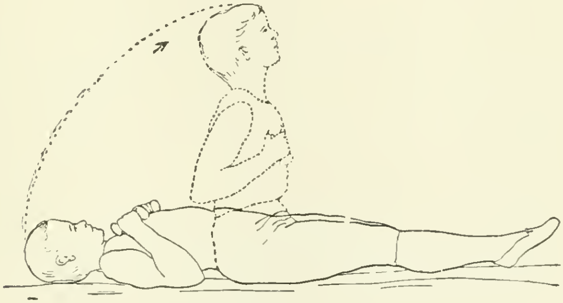


FIG. 26.

When a heavy bar is raised above the head, with both hands, the patient must fix the eyes upon the middle of the bar, to maintain an equilibrium. This necessitates the bending of the head backward, the straightening and hyperextending the spine, and consequently correcting a faulty position with a weight superimposed. The heavier the weight put above the head, whether with one hand or with two, the more the patient must exert himself or herself to attain and maintain a correct or an improved attitude in order to sustain the equilibrium. (By an improved attitude, I mean the greatest amount of correction of the deviation of the spine that the fixation of a deformity will allow of.) Hence, the greater the weight, the more forcible the actions of the muscles become, and the greater the temporary reduction of a deformity. It is by means of frequent and forcible temporary reductions of deformities, by voluntary muscular action, that we can hope to improve and do improve those cases which are amenable to any form of active treatment.

When a patient, lying supine upon the floor, raises a heavy bar above the head so that the arms are perpendicular to the floor, the weight of the bar, the position and weight of the body, and the action of the muscles tend to broaden the entire back and shoulders, and a slow downward movement tends to widen the entire chest, and most markedly at the shoulders. The frequent repetition of the upward and downward movement plays an important part in the rapid development of the chest and back. Pushing the bells above the head, swinging them with each hand separately and with both hands together, raising a bar above the head, standing and lying down, and the exercises before enumerated, constitute one day's work.

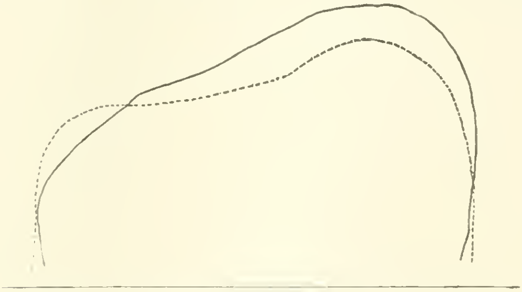


FIG. 27.—Tracing of back of Case III at point of greatest deformity. Solid line tracing taken November, 1894, after plaster-of-Paris jacket had been worn. Broken line tracing taken by Dr. Newton M. Shaffer, at the meeting of the Orthopædic Section of the New York Academy of Medicine, May 17, 1895.

As the amount of work performed by a patient depends upon the last previous record of that patient, that record must be improved upon at each succeeding visit, unless there be a good and sufficient reason to the contrary. Most patients can well stand three treatments a week. In mild, habitual cases improvement in deportment is noticed by the patients' relatives and friends and by the patients themselves, within the first two weeks. In those cases twenty *séances* usually suffice to effect a complete cure. In the more severe cases it is not and cannot be expected to attain such rapid results, but a certain appreciable improvement is effected, and I believe that the amount of improvement depends upon the persistent continuance of the treatment. Where there is a fixed rotation of long standing, with bony and ligamentous changes, the prospects are not so good, but even in those cases, I am sure that I can show considerable improvement in their conditions.

Patients are not permitted to wear supports of any kind, not even corsets. They should not exercise until at least two hours after a meal, nor when menstruating. The general health is improved by the exercises, the patients gain in height and weight. The girths and breadth measurements, chest depth, strength tests, and lung capacity are generally increased, and the depth of the abdomen is usually decreased. In some cases, especially those of undersized patients, the increase in height is very rapid, and it is certainly more than the increase by ordinary growth. There were marked cases of flat-foot which were benefited, as will be seen by reference to the charts. The flat feet became shorter through the exercises by the increase in depth of the inner arches.

This system of work should only be applied by the physician, and he must himself have been trained to the work, to intelligently guide those whom he seeks to benefit. The work must be careful, systematic, and regular. Perfunctory work will not do.

### Report of Cases treated.

Case I.—Dorothy S., aged six and a half years. Patient had a very marked protrusion of the sterno-costal cartilages on the right side. The deformity was so great as to be plainly visible when the child was dressed. The eminence formed was fully an half inch above the level of the chest. Treatment was begun December 4, 1894. Patient, despite her youth, was apt, quick, and attentive, and progressed very favorably. Her work was interrupted by being ill with diphtheria, which left her weak for some time. She worked thirty times from December 4, 1894, to April 20, 1895, and her record of work on the latter date was the following, viz.: Exercise with two-pound bells.

December 6, 1894. May 6, 1895.

| | FIRST MEASURE | MINIMUM | 95 | 90 | 80 | 70 | 60 | ABOVE 50 | 40 | 30 | 20 | 10 | 5 | MAXIMUM | LAST MEASURE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | 10 | 20 | 30 | 40 | BELOW 50 | 60 | 70 | 80 | 90 | 95 | | | |
| Age | 6 y. 8 mo | | | | | | | | | | | | | | 7 yr. | Age |
| Weight | 22.7 | | | | | | | | | | | | | | 23.8 | Weight |
| Height Standing | 117.0 | | | | | | | | | | | | | | 118.3 | Standing Height |
| " Sitting | 64. | | | | | | | | | | | | | | 64.4 | Sitting " |
| " Knee | 28. | | | | | | | | | | | | | | 29.5 | Knee " |
| " Pubic Arch | 53.5 | | | | | | | | | | | | | | 56.5 | Pubic Arch " |
| " Sternum | 92.3 | | | | | | | | | | | | | | 93.6 | Sternum " |
| Girth Head | 50.8 | | | | | | | | | | | | | | 51.5 | Head Girth |
| " Neck | 24.2 | | | | | | | | | | | | | | 25.5 | Neck " |
| " Chest | 50.2 | | | | | | | | | | | | | | 54.0 | Chest " |
| " " Full | 59.0 | | | | | | | | | | | | | | 61.5 | F " " |
| " Waist | 53.3 | | | | | | | | | | | | | | 56.5 | Waist " |
| " Hips | 62.2 | | | | | | | | | | | | | | 66.0 | Hips " |
| " Thigh R | 36.8 | | | | | | | | | | | | | | 37.0 | R Thigh " |
| " " L | 36.2 | | | | | | | | | | | | | | 37.0 | L " " |
| " Knee R | 25.7 | | | | | | | | | | | | | | 27.0 | R Knee " |
| " " L | 25.4 | | | | | | | | | | | | | | 27.0 | L " " |
| " Calf R | 24.5 | | | | | | | | | | | | | | 26.0 | R Calf " |
| " " L | 24.2 | | | | | | | | | | | | | | 26.0 | L " " |
| " Instep R | 17.5 | | | | | | | | | | | | | | 18.0 | R Instep " |
| " " L | 17.5 | | | | | | | | | | | | | | 18.0 | L " " |
| " Up Arm R | 16.8 | | | | | | | | | | | | | | 20.5 | R Up Arm Girth |
| " " L | 16.5 | | | | | | | | | | | | | | 20.0 | L " " " |
| " Elbow R | 16.0 | | | | | | | | | | | | | | 17.5 | R Elbow " |
| " " L | 16.0 | | | | | | | | | | | | | | 17.5 | L " " |
| " Fore Arm R | 16.6 | | | | | | | | | | | | | | 18.5 | R Fore Arm " |
| " " L | 16.6 | | | | | | | | | | | | | | 18.5 | L " " |
| " Wrist R | 11.5 | | | | | | | | | | | | | | 12.5 | R Wrist " |
| " " L | 12.1 | | | | | | | | | | | | | | 13.0 | L " " |
| Depth Chest | 14.0 | | | | | | | | | | | | | | 14.6 | Chest Depth |
| " Abdomen | 15.2 | | | | | | | | | | | | | | 15.3 | Abdomen " |
| Breadth Head | 14.2 | | | | | | | | | | | | | | 14.3 | Head Breadth |
| " Neck | 8.0 | | | | | | | | | | | | | | 8.0 | Neck " |
| " Shoulders | 26.7 | | | | | | | | | | | | | | 27.4 | Shoulders " |
| " Waist | 17.4 | | | | | | | | | | | | | | 16.5 | Weist " |
| " Hips | 22.0 | | | | | | | | | | | | | | 21.0 | Hips " |
| Shoulder-Elbow R | 24.2 | | | | | | | | | | | | | | 24.4 | R Shoulder-Elbow |
| " " L | 24.2 | | | | | | | | | | | | | | 24.4 | L " " |
| Elbow-Tip R | 30.7 | | | | | | | | | | | | | | 31.3 | R Elbow-Tip |
| " " L | 31.2 | | | | | | | | | | | | | | 31.5 | L " " |
| Length Foot R | 19.8 | | | | | | | | | | | | | | 20.4 | R Foot Length |
| " " L | 19.8 | | | | | | | | | | | | | | 20.3 | L " " |
| " Horizontal | 118.0 | | | | | | | | | | | | | | 120.1 | Horizontal " |
| Stretch of Arms | 116.0 | | | | | | | | | | | | | | 118.6 | Stretch of Arms |
| Capacity Lungs | 56.0 | | | | | | | | | | | | | | 70.0 | Lungs Capacity |
| Strength Lungs | 0.4 | | | | | | | | | | | | | | 0.7 | Lungs Strength |
| " Back | 22.8 | | | | | | | | | | | | | | 35.0 | Back " |
| " Legs | 25.0 | | | | | | | | | | | | | | 45.0 | Legs " |
| " Chest | 5.0 | | | | | | | | | | | | | | 8.0 | Chest |
| " Upper Arms | 0.0 | | | | | | | | | | | | | | 0.0 | Upper arms " |
| " Fore Arms | 10.0 | | | | | | | | | | | | | | 12.0 | Fore Arms " |
| " Total | 63.2 | | | | | | | | | | | | | | 100.7 | Total " |
| Development | | | | | | | | | | | | | | | | Development |
| Vision | | | | | | | | | | | | | | | | Vision |
| Hearing | | | | | | | | | | | | | | | | Hearing |

(Dr. Sargent has no chart for plotting averages under 10 years.)

CHART No. 1.

Pushed two ten-pound bells sixty times; two eight-pound bells eighty times; swung two ten-pound bells eight times, swung one twelve-pound bell twenty times with each hand, and raised a twenty-six pound bar ten times above the head standing and fifteen times lying down.[1] Now the former protrusion is hardly noticeable, and she can cause it to disappear entirely by posture. This I consider a good result with a deformity that is generally acknowledged to be almost unmanageable. Unfortunately, I have no photographs. I have taken measurements, but Dr. Sargent has no charts for "plotting" percentages under ten years of age. (See Chart No. 1.)

Case II.—Martha S., aged fifteen years; December 4, 1894. Had well-marked S-curve, dorsal to the right. Patient was under treatment by light gymnastics about two years ago. She was awkward, indolent, lazy, slow of perception, and took no interest in her work. Frequently she absolutely refused to do anything that required an effort, simply saying, "I can't." Her visits to my office were very irregular, and she did not visit me after March 30, except on May 4, when she came, at my request, to be measured and photographed. An half-inch cork sole for right shoe was ordered, which patient would not wear. Her first photograph, which was taken in November, 1892, is unsatisfactory, but it will show her deformity at that time. She has materially improved. She exercised with three-pound bells. She pushed two twenty-pound bells sixty times; swung one twenty-five-pound bell fifty times with each hand, and two twenty-five-pound bells twenty times, with both hands, above the head, and raised a fifty-pound bar ten times above the head standing and eighteen times lying down. (See Chart No. 2, and photographs.)

Case III.—Sophie C., aged nine years; December 3, 1894. Had a firmly-fixed and severe S-curve, the dorsal convexity to the right. This patient has been deformed, and under various forms of treatment since she was fourteen months old. She was an inmate of the Hospital for Ruptured and Crippled from March to October, 1894. Her history and measurements were taken when she was admitted to the hospital, and she was measured at the hospital upon the same lines through the kindness of Dr. Gibney, on April 25, 1895. I will give the measurements, as taken from "History Book No. 2," of the Hospital for Ruptured and Crippled, p. 38.

"March 5, 1894. Left ilio-costal curve higher than normal and very deep, the skin wrinkled in ridges extending obliquely from inferior angle of left scapula to left anterior superior spine: Inferior angle of left scapula one and a half inches lower than the right, but hugs the

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[1] The patient was presented for examination.

December 6, 1894. May 4, 1895.

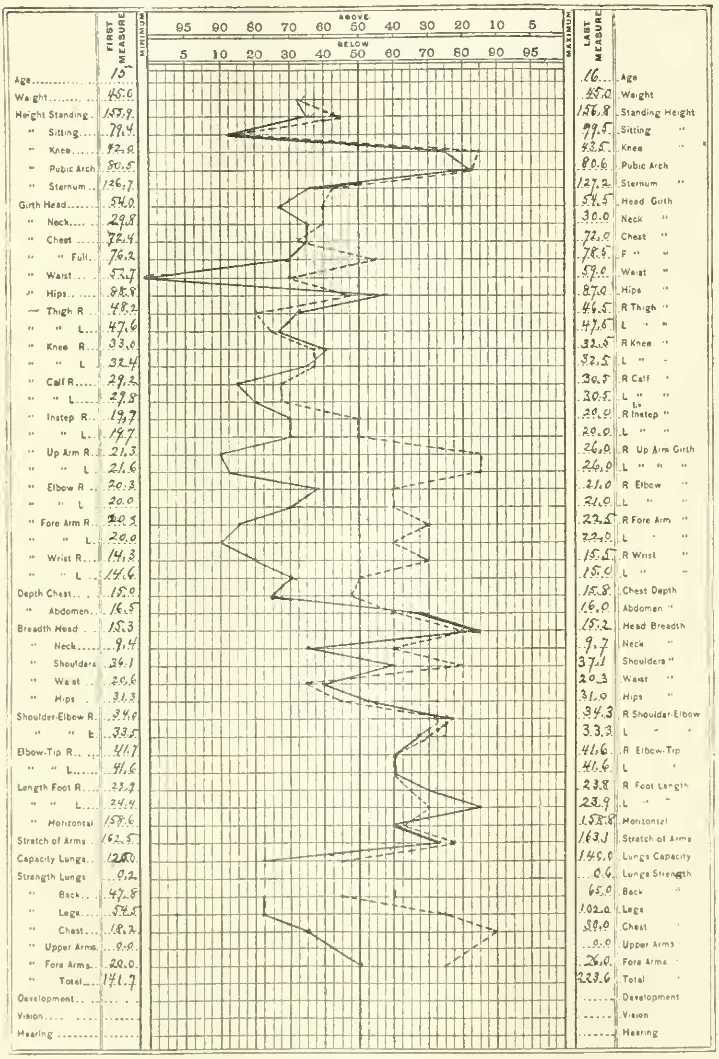

CHART No. 2.

chest wall closely, as does the right. Ribs on the right side project backward from centre of right scapula to level of right elbow. At centre of curve, which is the seventh or eighth dorsal vertebra, they project one and a half inches behind those of left side. Costo-iliac curve on right side obliterated. Head inclined to right shoulder.

"*In front.* Left mamma and chest prominent, right flattened, left shoulder lower and thrown backward. Anterior superior spine on left side elevated. Key-note position has little effect on curve. *Stooping.*—Rotation well marked. Ribs on right side two inches higher at centre of curve than on the left.

"Little effect produced by pressure on ribs of right side at the same time supporting the left shoulder."

I understand that these measurements were taken, the patient lying prone upon a table. The words "in front," I take to indicate that the patient was lying upon her back.

From the time of her admission she was given light gymnastics by me almost daily until the middle of June, after which she was exercised by the then house surgeon, Dr. Winter, until about August 1. Dr. Winter believed that she had markedly improved from the time of her admission until the middle of June; he believed that she was at a stand-still while he had her under his treatment, and he further stated that she became worse from August 1, when exercises were discontinued, until she was discharged from the hospital in a fixed plaster-of-Paris jacket.

December 3, 1894, she returned to me, at my request, for private treatment, to see what could be accomplished in such a severe and long-standing case, by heavy gymnastics and exercises only, and without support. I ordered, however, the shoe of the right foot raised one inch, to throw the weight more upon the left foot.

Work was commenced December 3, 1894. The patient was very willing, but awkward, and teaching her was laborious. The extreme deformity, its fixation, the duration, the immobility of the spine, and the severe rotation were such that I could not hope to make any great change in the contour of her trunk by active treatment.[1] I reasoned, however, that if I could only slightly improve her condition, I could certainly very much improve milder cases. The patient has improved, although the work was seriously interfered with by frequent toothaches and indispositions. (She is a child of poor parents, and it is my opinion that proper nutriment has been wanting.) Her spine is mobile. She can now hold herself in a comparatively good position. She has gained a great deal in strength, and to my eye her deformity appears less marked than when treatment was begun. She was photographed at the hospital, and I was not in a position to photograph her when she began treatment with the heavy work. Her record in this regard is imperfect.

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[1] See tracing.

I quote from "Ward Book" of the hospital, p. 697.

"April 25, 1895. General condition much improved. Been under Dr. Teschner's treatment since discharge from hospital. Comes in for examination to-day, one inch cork on right foot.

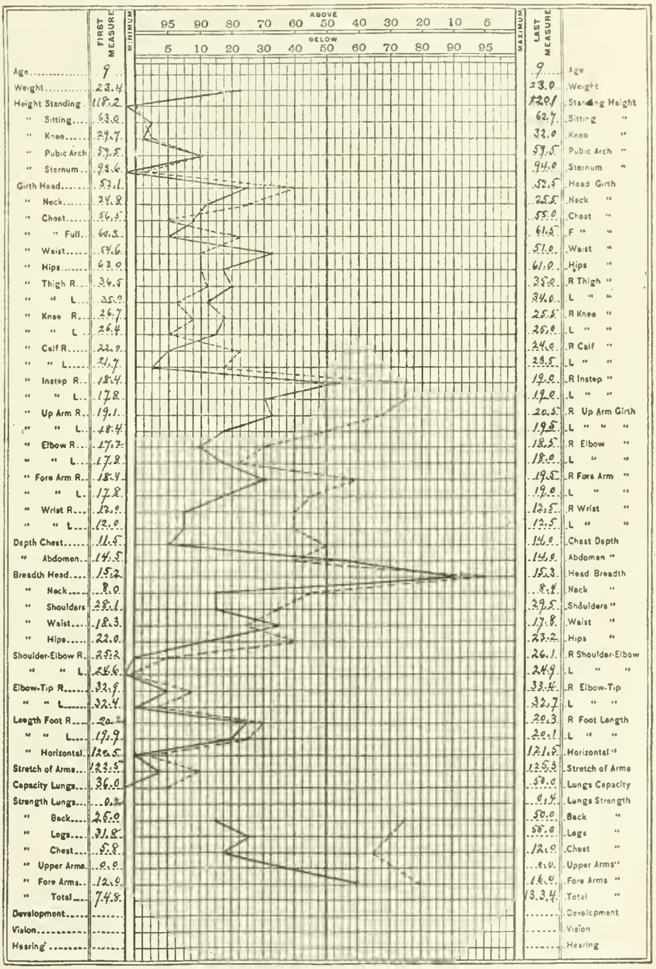
"Left shoulder markedly lower than the right. Left ilio-costal curve higher than normal and very deep. Lower angle of left scapula on a plane one and a quarter inches lower than right but hugs chest closely.

"Chest walls one and a half inches higher on right than left. Chest in front flattened and free ribs very prominent. Key-note corrects somewhat."

The hospital record, although meagre and vague, shows improvement in the general condition and actual improvement in the deformity. Over a year had elapsed between the two observations, and the patient certainly grew in that time. My record shows an increase of 1.9 centimetres from December 6, 1894, to April 16, 1895. Ordinary growth and development of a child with a deformity, even though the progress of the deformity were at a stand-still, would, by increase in the size of the skeleton, cause the measurements of the comparative heights of the scapulæ, and of the differences of the elevated and depressed planes of the surfaces of the chest wall, to become greater. In this case the record shows that, at both examinations, the right chest wall (back) was one and a half inches more prominent than on the left; that the angles of the scapulæ, which were on planes one and a half inches apart at the first examination, were one and a quarter inches apart on the second examination. The first record says, "Key-note position has little effect on curve;" the second record says "Key-note corrects *somewhat.*" One measurement has not varied, which, to my mind, indicates progress, and the other has improved one-quarter of an inch, which indicates still more progress. The second observation records a flat chest, while the first records the left side of chest prominent. I will show the key-note correction. By request, Dr. Shaffer took a tracing of the patient's back. (See tracing.)

Her strength tests and lung capacity have increased, as can be seen by her chart. She exercises with a pair of two-pound dumb-bells. She pushes a fifteen-pound bell thirty or more times from the shoulder above the head, she swings a twenty-pound bell with one hand, and two fifteen-pound bells with both hands above the head. She raises a thirty-six-pound bar above the head ten times standing, and a fifty-pound bar twelve times above the head lying down. All this she will demonstrate. Since March 12, I con-

December 6, 1894. April 16, 1895.



(Plotted on 10 year chart.)

CHART No. 3.

cluded to give her more left-handed pushing and swinging. Until May 1 she has exercised forty-five times. (See Chart No. 3 and photographs.)

CASE IV.—Lillie L., aged sixteen years; December 13, 1894. Had a firmly fixed S-curve, the dorsal convexity to the right, similar but less severe than Case No. 3. This patient has also been under different kinds of treatment for the past four years. From March 14 to May 12. 1894, she was treated by me by ordinary gymnastics without weights, and she improved slightly. About the middle of May she left the city for her home in Texas, where she remained until her return here in December last.

Upon her return, December 12, 1894, I found her in much worse condition than when she first came to me in May, 1894. The treatment by heavy work was commenced December 13, 1894. The patient was very willing and apt, and progressed favorably in her work.

She exercises with a pair of three-pound bells. She pushes a thirty-pound bell about fifteen to twenty times with each hand alternately; she swings two thirty-pound bells thirty times above the head, and also swings one forty-pound bell with each hand fifty times. She raises a seventy-eight-pound bar sixteen times above the head standing, and sixteen times lying down.

I have gained so much in this case by this treatment that I am led to hope for a very good ultimate result, as the patient carries herself well now, despite the great rotation, which you see, and she works with intelligence and a will. (See Chart No. 4 and photographs.)

CASE V.—Edith S., aged sixteen years, came for treatment December 13, 1894. Had a fixed lower dorsal scoliosis to the right (C-curve), which could be partially obliterated by suspension. It was very difficult to instruct this patient in her work. She was awkward, listless, morose, and entirely devoid of will or energy, although she is reported to stand well in her studies in the Normal College of this city. She was very anæmic, and carried considerable flabby fat. She had well-marked, but painless, double flat-foot. This patient made but little progress for the first three weeks of treatment, but after that time she acquired a certain amount of grace in her movements; she exercised with a will, displayed considerable energy and strength, and improved from that time on, so that now she is practically well. I think, however, that she should continue the treatment at intervals to offset her disposition and sedentary habits. (There are no photographs of this case.) Both feet became shorter,

December 13, 1894. April 16, 1895.

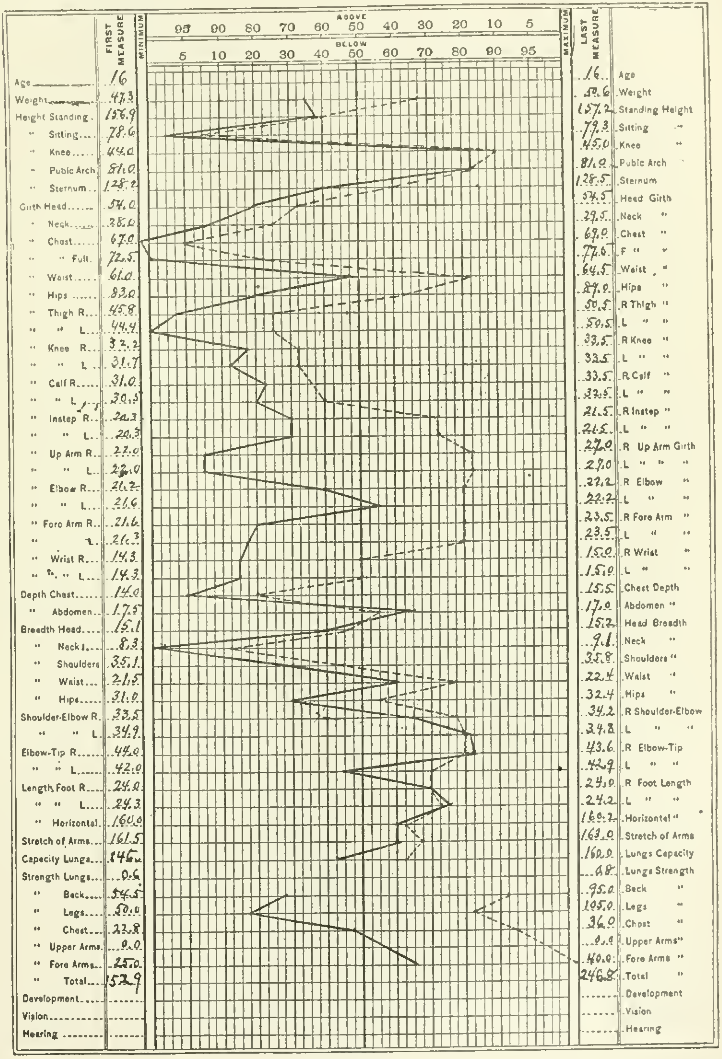


CHART NO. 4.

through the increase of the depth of the arches. She uses three-pound bells for exercises, and nearly the same heavy weights as Case III. (See Chart No. 5.)

Case VI.—Jessie K., aged twelve years; began treatment January 29, 1895. Patient is very tall and large for her age. Had a

December 13, 1894. April 4, 1895.

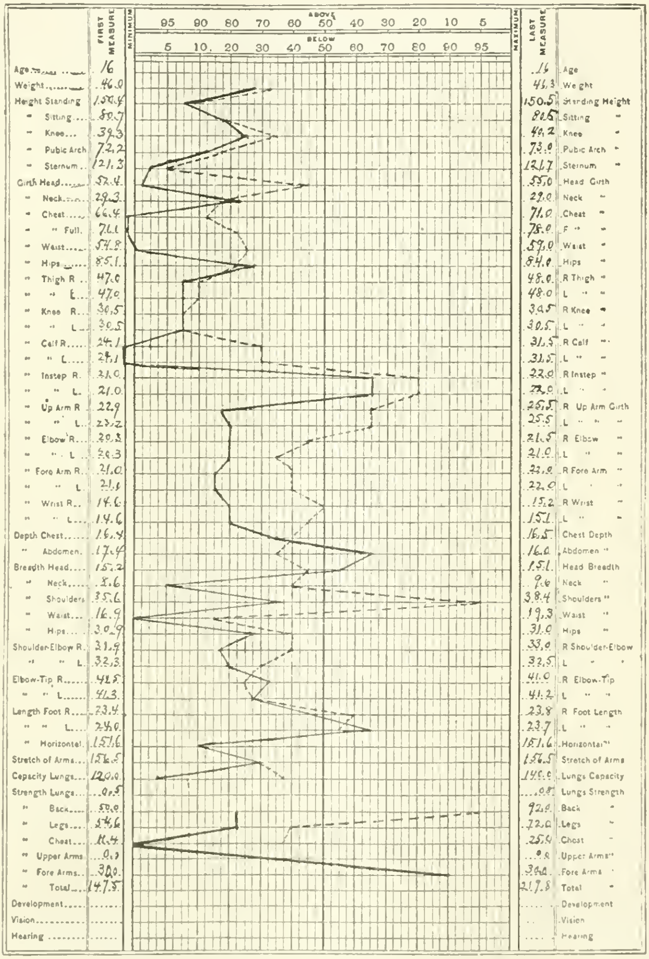


Chart No. 5.

rib exsection on left side (performed by Drs. George W. Jacoby and A. H. Friedenberg) for empyema, before she was a year old. Mother noticed a slight S-curve of spine with very marked stoop shoulders, and a protruding abdomen about six months before this treatment. The curve could be obliterated by the muscular efforts

January 29, 1895. April 13, 1895.

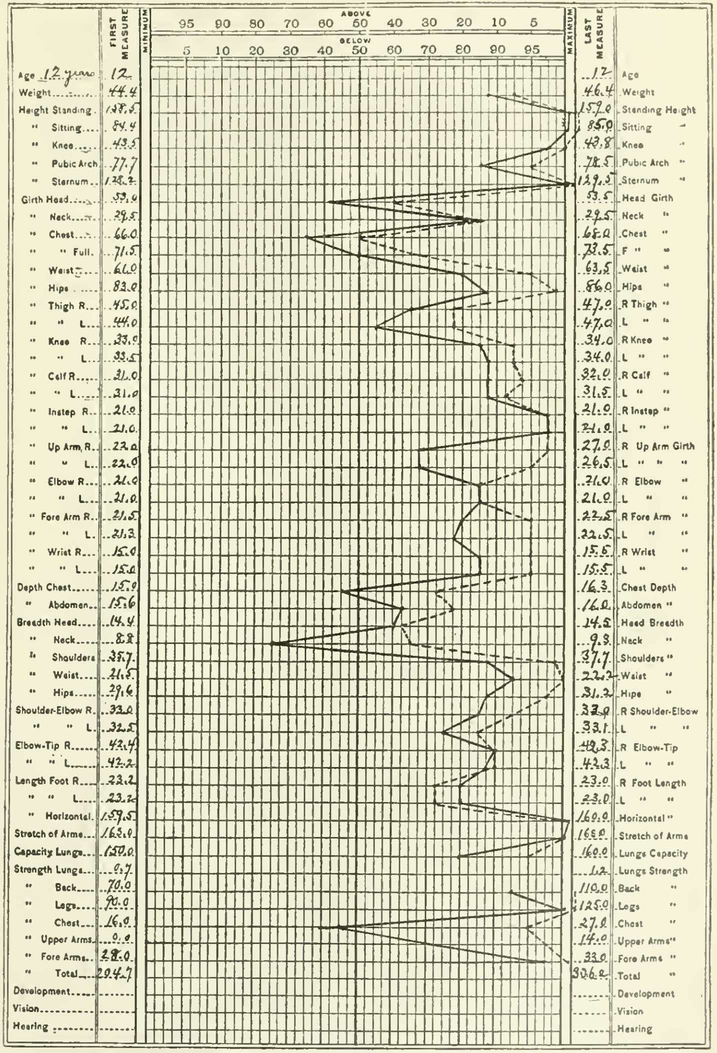
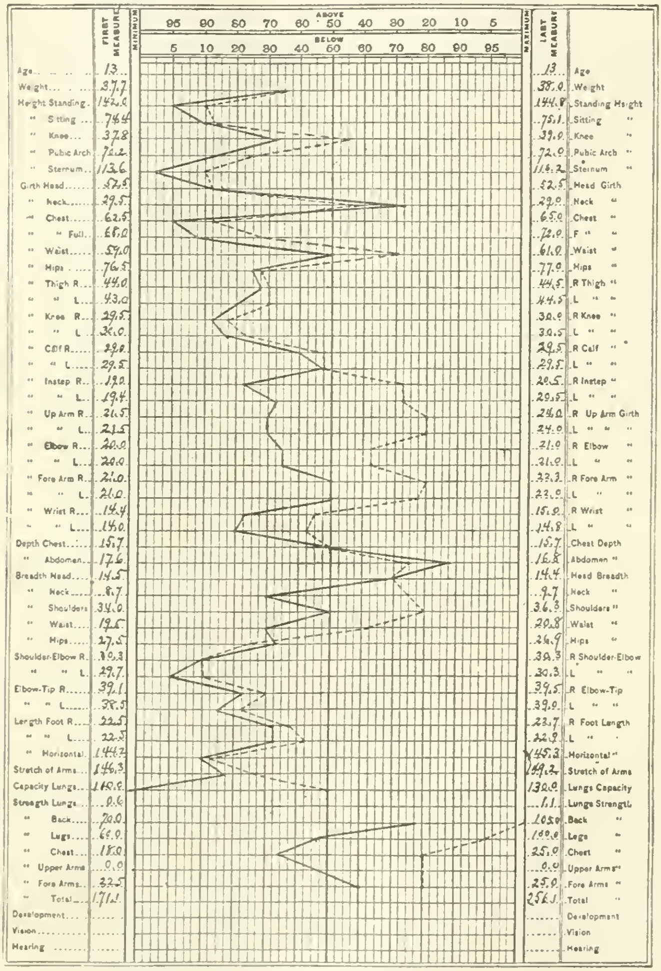


CHART No. 6.

of the patient. Exercises were begun. The patient was willing and apt, and showed marked improvement very quickly. Her mother, a very intelligent lady, reported that a vast improvement was noticed after patient had exercised five or six times. Her entire deportment had changed. On April 13, her twentieth *séance*, she was discharged cured. On that day her record of work was the following,—viz.:

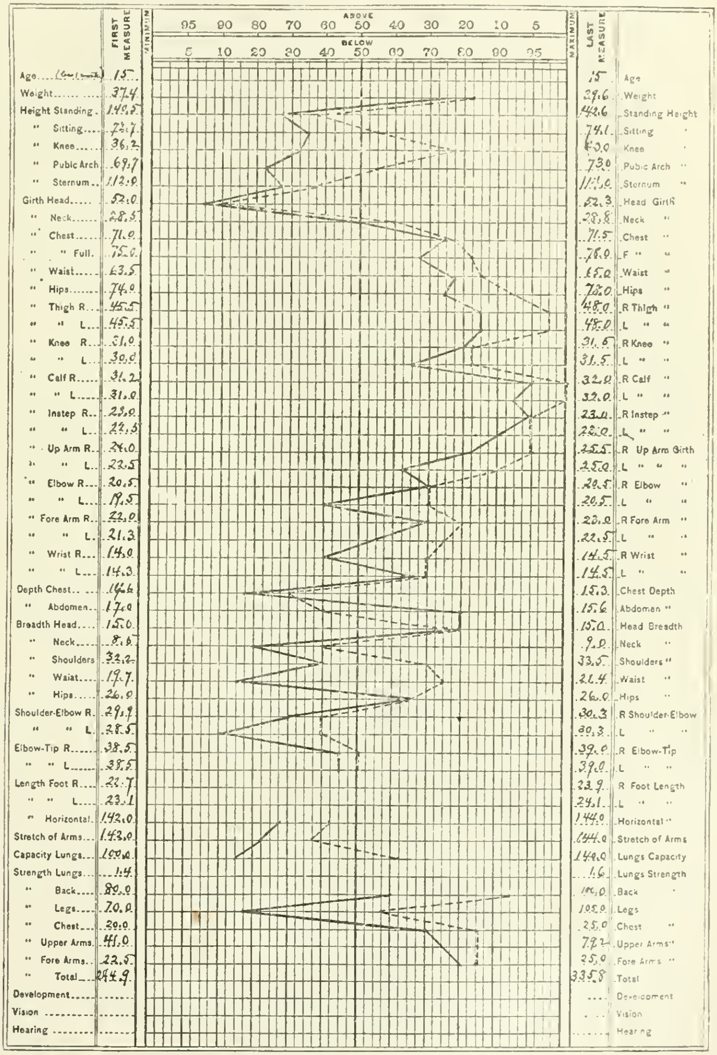
February 16, 1895. April 18, 1895.



Second measurements taken after seventeen *séances*.
CHART No. 7.

Exercised with three-pound bells; pushed two twenty-five pound bells thirty times above the head; swung two twenty-five pound bells seven times; swung one thirty-pound bell fifteen times with each hand, and raised a sixty-four pound bar ten times above the head standing, and fifteen times lying down. (See Chart No. 6.)

February 17, 1895. April 23, 1895.



| | FIRST MEASURE | LAST MEASURE | |
|---|---|---|---|
| Age .... [illegible] | 15 | 15 | Age |
| Weight | 37.4 | 39.6 | Weight |
| Height Standing | 140.5 | 142.6 | Standing Height |
| " Sitting | 73.7 | 74.1 | Sitting " |
| " Knee | 36.2 | 40.0 | Knee " |
| " Pubic Arch | 69.7 | 73.0 | Pubic Arch " |
| " Sternum | 112.0 | 113.0 | Sternum " |
| Girth Head | 52.0 | 52.3 | Head Girth |
| " Neck | 28.5 | 28.8 | Neck " |
| " Chest | 71.0 | 71.5 | Chest " |
| " " Full. | 75.0 | 76.0 | F " " |
| " Waist | 63.5 | 65.0 | Waist " |
| " Hips | 74.0 | 73.0 | Hips " |
| " Thigh R. | 45.5 | 48.0 | R Thigh " |
| " " L. | 45.5 | 48.0 | L " " |
| " Knee R. | 31.0 | 31.5 | R Knee " |
| " " L. | 30.0 | 31.5 | L " " |
| " Calf R. | 31.2 | 32.0 | R Calf " |
| " " L. | 31.0 | 32.0 | L " " |
| " Instep R. | 23.0 | 23.0 | R Instep " |
| " " L. | 22.5 | 22.0 | L " " |
| " Up Arm R. | 24.0 | 25.5 | R Up Arm Girth |
| " " L. | 22.5 | 25.0 | L " " " |
| " Elbow R. | 20.5 | 20.5 | R Elbow " |
| " " L. | 19.5 | 20.5 | L " " |
| " Fore Arm R. | 22.0 | 23.0 | R Fore Arm " |
| " " L. | 21.3 | 22.5 | L " " |
| " Wrist R. | 14.0 | 14.5 | R Wrist " |
| " " L. | 14.3 | 14.5 | L " " |
| Depth Chest | 14.6 | 15.3 | Chest Depth |
| " Abdomen | 17.0 | 15.6 | Abdomen " |
| Breadth Head | 15.0 | 15.0 | Head Breadth |
| " Neck | 8.6 | 9.0 | Neck " |
| " Shoulders | 32.2 | 33.5 | Shoulders " |
| " Waist | 19.7 | 21.4 | Waist " |
| " Hips | 26.0 | 26.0 | Hips " |
| Shoulder-Elbow R. | 29.7 | 30.3 | R Shoulder-Elbow |
| " " L. | 28.5 | 30.3 | L " " |
| Elbow-Tip R. | 38.5 | 39.0 | R Elbow-Tip |
| " " L. | 38.5 | 39.0 | L " " |
| Length Foot R. | 22.7 | 23.9 | R Foot Length |
| " " L. | 23.1 | 24.1 | L " " |
| " Horizontal | 142.0 | 144.0 | Horizontal " |
| Stretch of Arms | 143.0 | 144.0 | Stretch of Arms |
| Capacity Lungs | 100.0 | 140.0 | Lungs Capacity |
| Strength Lungs | 1.4 | 1.6 | Lungs Strength |
| " Back | 80.0 | 100.0 | Back " |
| " Legs | 70.0 | 105.0 | Legs |
| " Chest | 30.0 | 25.0 | Chest " |
| " Upper Arms | 41.0 | 79.2 | Upper Arms " |
| " Fore Arms | 23.5 | 25.0 | Fore Arms " |
| " Total | 244.9 | 335.8 | Total |
| Development | | | Development |
| Vision | | | Vision |
| Hearing | | | Hearing |

(Plotted on 12 year chart.)

Second measurements taken after seventeen *séances*.

CHART No. 8.

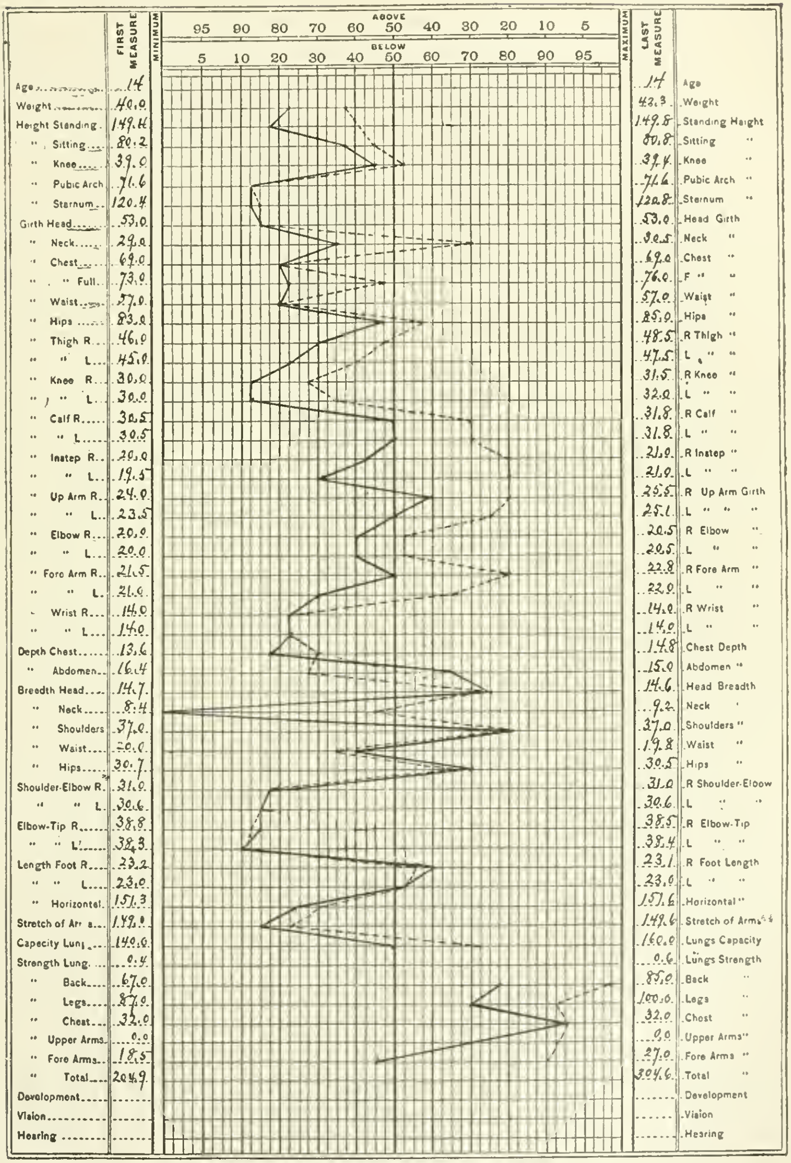
Case VII.—Mollie N., aged thirteen years; began treatment February 16, 1895. This patient was fat, chubby, and undersized. She was brought to me for round shoulders and weak back. Examination revealed a slight habitual C-curve to the right. Patient's work, which was very good, was interrupted twice, each time for ten days, by severe attacks of tonsillitis. Her improvement in carriage was very well marked and rapid, and she was discharged cured, on April 27, after twenty *séances*, having gained 2.6 centimetres in height. Her record of work at that time was the following,—viz.: Exercised with three-pound bells. Pushed two fifteen-pound bells 100 times. Swung two twenty-pound bells twenty-eight times. Swung one twenty-five-pound bell fifty times with each hand, and raised the sixty-four-pound bar fifteen times above the head standing, and fifteen times lying down. (See Chart No. 7 and photographs.)

Case VIII.—Jerome L., aged fifteen years, came for treatment February 17, 1895. The history of this case appears in the earlier part of this paper, page 228; I will therefore not repeat it. He was practically cured on April 23, having gained 2.1 centimetres in height, and his record of work was the following,—viz.: Exercised with three-pound bells. Pushed two twenty-pound bells seventy times. Swung two thirty-pound bells six times, and swung one thirty-pound bell forty times with each hand. Raised a seventy-eight-pound bar twelve times above the head standing, and twenty times lying down. (See Chart No. 8 and photographs.)

Case IX.—Debby M., aged fourteen years; April 6, 1895. Patient had a well-marked lower dorsal curve; the right scapula was quite prominent. The deformity could be partially obliterated by muscular effort. Ordered the sole of right shoe to be raised three-eighths of an inch, and exercises commenced. The patient is intelligent and, through her strong desire to get well, was attentive and manifested much vigor, will, and perseverance in her work. Her improvement was nothing short of marvellous, as I am enabled to show her to you, six weeks from the beginning of the treatment, without any deformity. As I stated in an earlier portion of this paper, I will give the entire record of work of this patient, to demonstrate its progressive character. (See Chart No. 9 and photographs.)

A few words in defence of this heavy work against the adverse criticisms of those who might condemn it, either from their hearsay knowledge of its baneful effects, or from their own observations of athletes, who have been "trained down" for special work.

April 6, 1895. May 14, 1895.



| | FIRST MEASURE | LAST MEASURE | |
|---|---|---|---|
| Age | 14 | 14 | Age |
| Weight | 40.0 | 42.3 | Weight |
| Height Standing | 149.4 | 149.8 | Standing Height |
| " Sitting | 80.2 | 80.8 | Sitting " |
| " Knee | 39.0 | 39.4 | Knee " |
| " Pubic Arch | 71.6 | 71.6 | Pubic Arch " |
| " Sternum | 120.4 | 120.8 | Sternum " |
| Girth Head | 53.0 | 53.0 | Head Girth |
| " Neck | 29.0 | 30.5 | Neck " |
| " Chest | 69.0 | 69.0 | Chest " |
| " " Full | 73.0 | 76.0 | F " " |
| " Waist | 57.0 | 57.0 | Waist " |
| " Hips | 83.0 | 85.0 | Hips " |
| " Thigh R | 46.0 | 48.5 | R Thigh " |
| " " L | 45.0 | 47.5 | L " " |
| " Knee R | 30.0 | 31.5 | R Knee " |
| " " L | 30.0 | 32.0 | L " " |
| " Calf R | 30.5 | 31.8 | R Calf " |
| " " L | 30.5 | 31.8 | L " " |
| " Instep R | 20.0 | 21.0 | R Instep " |
| " " L | 19.5 | 21.0 | L " " |
| " Up Arm R | 24.0 | 25.5 | R Up Arm Girth |
| " " L | 23.5 | 25.1 | L " " " |
| " Elbow R | 20.0 | 20.5 | R Elbow " |
| " " L | 20.0 | 20.5 | L " " |
| " Fore Arm R | 21.5 | 22.8 | R Fore Arm " |
| " " L | 21.0 | 22.0 | L " " |
| " Wrist R | 14.0 | 14.0 | R Wrist " |
| " " L | 14.0 | 14.0 | L " " |
| Depth Chest | 13.6 | 14.8 | Chest Depth |
| " Abdomen | 16.4 | 15.0 | Abdomen " |
| Breadth Head | 14.7 | 14.6 | Head Breadth |
| " Neck | 8.4 | 9.2 | Neck |
| " Shoulders | 37.0 | 37.0 | Shoulders " |
| " Waist | 20.0 | 19.8 | Waist " |
| " Hips | 30.7 | 30.5 | Hips " |
| Shoulder-Elbow R | 31.0 | 31.0 | R Shoulder-Elbow |
| " " L | 30.6 | 30.6 | L " " |
| Elbow-Tip R | 38.8 | 38.5 | R Elbow-Tip |
| " " L | 38.3 | 38.4 | L " " |
| Length Foot R | 23.2 | 23.1 | R Foot Length |
| " " L | 23.0 | 23.0 | L " " |
| " Horizontal | 151.3 | 151.6 | Horizontal " |
| Stretch of Arms | 149.0 | 149.6 | Stretch of Arms |
| Capacity Lungs | 140.0 | 160.0 | Lungs Capacity |
| Strength Lung | 0.4 | 0.6 | Lungs Strength |
| " Back | 67.0 | 85.0 | Back " |
| " Legs | 87.0 | 100.0 | Legs " |
| " Chest | 32.0 | 32.0 | Chest " |
| " Upper Arms | 0.0 | 0.0 | Upper Arms " |
| " Fore Arms | 18.5 | 27.0 | Fore Arms " |
| " Total | 204.9 | 304.6 | Total " |
| Development | | | Development |
| Vision | | | Vision |
| Hearing | | | Hearing |

Second measurements taken after thirteen *séances*.

CHART NO. 9.

RECORD OF WORK OF DEBBY M. IN CASE IX.

| DATE. | REGULAR EXERCISES. | PUSHING. | SWINGING WITH EACH HAND. | SWINGING WITH BOTH HANDS. | PUSHING. | FIFTY-POUND BAR ABOVE THE HEAD. | |
|---|---|---|---|---|---|---|---|
| 1895. | Bells. | Two 10-lb. Bells. | One 15-lb. Bell. R.—L. | Two 15-lb. Bells. | Two 20-lb. Bells | Standing. | Lying Down. |
| April 6. | 3 lbs. | . . . . | . . . . | . . . . | . . . . | . . | . . |
| " 9. | " | 100 | 10—10 | 5 | . . . . | Instructed. | Instructed. |
| " 11. | " | 150 | 25—25 | 15 | 10 | 2 | 5 |
| | | 2 15-lb. bells. | 1 20-lb. bell. | | | | |
| " 13. | " | 50 | 25—25 | 25 | 12 | 5 | 10 |
| " 16. | " | 54 | 30—30 | 35 | 18 | 7 | 12 |
| " 18. | " | 60 | 35—35 | 40 | 20 | 7 | 15 |
| | | | 1 25-lb. bell. | 2 20-lb. bells. | | | |
| " 20. | " | 70 | 20—20 | 20 | 30 | 10 | 15 |
| " 25. | " | 90 | 22—22 | 25 | 33 | 15 | 16 |
| " 27. | " | 100 | 35—35 | 30 | 50 | 17 | 20 |
| " 30. | " | 110 | 50—50 | 35 | 60 | 20 | 22 |
| May 2. | " | 120 | 60—60 | 36 | 70 | 20 | 25 |
| | | | 1 30-lb. bell. | | 2 25-lb. bells. | 64-lb. bar. | 64-lb. bar. |
| " 4. | " | 140 | 20—20 | 40 | 25 | 5 | 10 |
| " 7. | " | 150 | 25—25 | 45 | 30 | 7 | 12 |
| " 14. | " | 160 | 27—27 | 50 | 34 | 9 | 13 |
| " 16. | " | 170 | 30—30 | 55 | 40 | 10 | 14 |

The general health of my patients has been good. One shows a loss of weight, Case III (and that is only 0.4 kilo), which undoubtedly was caused by a recent indisposition. The heights, chest capacities, chest depths, girths, breadths, and strength-tests are generally increased, the abdominal depths are decreased, and the feet, the foundation of correct posture, are improved, inasmuch as all flat feet become shorter, and the normal feet grow. I have not detected any effect upon the hearts of the patients. All this should prove that they are not overworked.

To those gentlemen who are disposed to criticise my method of recording cases, by means of the "Sargent Charts"[1] and photographs, I will say that I know of no system which is absolute.

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[1] The "Sargent charts," which are copyrighted, are printed by permission of Dr. Dudley Allen Sargent.

# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, March 13, 1895.*

The President, Robert Abbe, M.D., in the Chair.

## SUTURE OF THE MUSCULO-SPIRAL NERVE.

Dr. B. B. Gallaudet presented a young man, showing the result of suture of the divided musculo-spiral nerve. The patient had come under his observation a year ago, the previous October, with a deep transverse cut about half-way down the arm, outer aspect, two inches long, There was absolute wrist-drop. Two days after the accident Dr. Gallaudet sought for the divided nerve. The original wound was rather ragged and he was not sure that he could find the nerve at the bottom of it, consequently he made an incision along the inner margin of the supinator longus and followed the nerve up to the wound. A little further search revealed the upper terminal, about a quarter of an inch from the lower. They came together readily by simply pulling upon them, and much more readily by flexing the forearm. The two nerve terminals were then sutured end to end by three fine silk sutures, and the arm was put up at right angles. It was left in this position ten days, when the wound was found to have healed primarily. The arm was kept in the flexed position about ten days longer, and was moved slightly at the elbow from day to day. The operation having been done in October, power had largely returned by the following July, and improvement continued subsequently until it had reached about its full extent in December, fourteen months after the suture. Massage had been employed in the beginning; electricity had been given only once or twice.

Dr. Abbe remarked that nine years ago he had resected an inch and a quarter of the musculo-spiral nerve in a woman for a small tumor, making immediate suture, and obtaining excellent approximation. A letter from the woman a year ago stated that she was still gaining in the use of her arm, but the hand was still numb, was moist, and there was some disability. For instance, she could not put her hand to her head. For a long time there had been very little improvement, although he had made careful primary suture of the nerve, the result in Dr. Gallaudet's case had been highly satisfactory and prompt.

Dr. McBurney thought the result in the case shown was as perfect as could possibly be expected, a better result will rarely be attained, if ever. One or two points deserved emphasis. Dr. Gallaudet had sutured the nerve *early* after the injury, a most important point in the case. A number of cases have been reported in which, for some reason or another, the practitioner, into whose hands the patients had fallen at the time of the injury had failed to appreciate the gravity of the situation, had simply dressed the general wound, and had allowed considerable time to elapse before giving special attention to the injury of the nerve. In such cases, when they had come to operation, the attempt to restore usefulness in the muscles by uniting the nerve had been made, but the results had not been satisfactory. Changes had taken place ; the ends of the nerve had atrophied to a very considerable degree, both in width and (apparently) in length. This was true even where the injury had been inflicted only two or three months before. The results of suture under these circumstances had amounted to nothing in the speaker's experience.

An illustrative case was one which he had seen last summer. A farmer had been bitten on the arm by a vicious stallion some months before. An ugly gash was inflicted, the nerve divided, the bone not crushed. The physicians who saw him simply treated the general wound, giving no particular attention to the nerve. When Dr. McBurney saw the patient there was complete wrist-drop and a great deal of pain in the course of the nerve. He did not look upon suture at this time with much favor, yet he cut down upon the nerve, found evidences of intense neuritis extending several inches up and down the nerve, the diameter of the nerve being two to four times greater than normal. He did not carry the attempt any further, but proceeded to amputate the limb above the point of injury in order to relieve the patient of his intense pain. There were many such cases on record where a limb had been lost by neglect on the part of the practitioner who had first seen the patient.

## RECURRENT SARCOMA OF THE BACK; PROPOSED TREATMENT BY MIXED TOXINES.

Dr. Abbe presented an aged man with a recurrent sarcomatous tumor, of moderate size, in the muscles of the back, from whom, last September, Dr. Curtis had removed a similar tumor, the size of an apple, microscopical examination of which showed a sarcoma with myxomatous tendency. It had been encapsulated in the latissimus dorsi, and was removed by enucleation. The president said he presented the patient, not because the case was at all unusual, but in order that the members might examine him before the administration of mixed erysipelatous toxines which it had been claimed had yielded beneficial results in some similar cases. Replying to a question as to whether he did not consider the case still suited for operative removal, he said that he would prefer removal if he were the patient and there were no hope from treatment by the toxines. The rule, however, was prompt recurrence after removal, and he would like to hear an expression of opinion as to the propriety of trying the toxine treatment.

Replying to a further question as to the ground on which he would use the toxines, he said on the statements of the enthusiastic advocates of that method. One or two gentlemen had classed this case among those which, it seemed, had given good results from this treatment.

Dr. McBurney remarked that he would not like to see this case put on record as one unlikely to be benefited by operation. It impressed him as one remarkably well suited for a proper kind of operation. He would not recommend what seemed to have been done before, that is, a simple incision over the tumor and enucleation. He would recommend extensive excision, including cicatrix and surrounding tissue. That, he thought, would be the proper treatment of the case, although he could see little objection to the use of toxines, yet personally he had high respect for vigorous surgical treatment of sarcoma situated where one could make a safe and thorough operation.

Dr. Abbe thought Dr. McBurney had described the proper surgical treatment of such cases; yet, at the same time, he could himself see no reason why the patient should not be given the benefit of the new treatment. He did not think the man would be injured much by a delay of three or four weeks, and if at the end of that time the toxines had produced no effect the tumor could be removed with the knife. In bringing the patient before the society, he had had in mind the assembling of a series of cases which the members might present before treatment by toxines with a view to learning something more definite with regard to the results of this method. He thought it behooved the society to investigate the new method either in this manner or by appointing a committee which should make observations in the different hospitals and report back to the society at a later date.

Dr. McBurney said he sympathized entirely with the plan of Dr. Abbe, and he saw no objection to using the new method in this case. But he would like to put this query, If the method was valuable, in what way did it act? He believed the toxine material did not go directly to the tumor and kill the tumor where it was, without having any special effect upon the individual. He had not heard much said on that point by the advocates of the treatment, but he supposed the theory was that the injected material became absorbed into the system and controlled the entire individual, and secondarily the tumor. In other words, that it interfered with the sarcoma-producing power of the individual.

If such were the correct theory, it might be a better application of it to remove the tumor and at the same time place the patient under the treatment by the toxines. First get rid of the tumor before it had gone too far, and also kill off the sarcoma-producing power. He would prefer that course to leaving the tumor *in situ* and depending entirely on the somewhat doubtful new procedure. There were a good many men of high authority who were very doubtful of the value of the remedy. He had subjected one patient to the course just mentioned. The patient had been operated upon twice by somebody else, and came to him for a second recurrence of the tumor which was not far from the region involved in Dr. Abbe's case. Dr. McBurney removed the tumor and immediately placed the patient upon the erysipelatous toxines, which were used faithfully for about a month. By that time he thought the patient had had enough, and he discharged him. The wound had healed long before. This was about three months ago, and a few days ago the patient had returned with a small tumor which had recurred in the muscle. This was very completely removed, but he had not put the patient again on the toxines.

Dr. L. S. Pilcher thought the question put by Dr. McBurney a very pertinent one to the whole subject of the manner in which erysipelatous injections produced their effect in modifying the growth of sarcomatous tumors. Upon the answer to that question must one base his defence of that treatment in this particular case. We might infer from the tenor of Dr. McBurney's remarks that he looked upon sarcoma as a local expression of a general condition. Such, he believed, was not the view held by pathologists at the present time. If it was true that sarcoma was a local disease, and that diffuse expressions of it were simply due to transference of particles to other parts of the body from the primary growth, it would seem that when the surgeon had removed the local tumor there was no necessity for general treatment. At any rate, he thought the surgeon would be on the defensive, at least, who should fail to avail himself of local extirpation and instead resort at once to a general method of treatment. He would submit the point for consideration as to how far in matters surgical we were at liberty to depart from means that were known to be of value and resort to others for the purpose of determining their possible advantage. Personally, he thought it would hardly be proper to apply the general treatment before local extirpation.

Dr. Abbe explained that he had omitted to state that when this man had entered the hospital he had expressed a wish not to be operated upon again.

## REMOVAL OF EPITHELIOMA OF LIP BY REGNIER'S METHOD.

Dr. Gallaudet read a paper entitled, "Epithelioma of Entire Lower Lip; Removal by the Method of Regnier." (See page 688, Vol. xxi.)

Dr. Abbe thought the method a valuable one. His own experience with removal of the entire lower lip had been by two methods, one consisting in working flaps in from the side, which gave a very good result except that the mouth was a little pinched; the other by bringing the parts up from below and sides. The latter, a German method, had given him the best results. A point which had impressed him was the manner in which the mucous membrane would spread from the gums out over the granulating surface, so that in the end one had a red lip with vermilion border.

Dr. McBurney acknowledged that there had been a very handsome result in Dr. Gallaudet's case, but he did not think the method compared with that of Malgaigne. The latter had some very superior points. One was that the lip was entirely covered with mucous membrane from the time the operation was finished. Another was that the lower lip was left entirely free from the teeth, so that one could place his finger between the teeth and the lip. In other words, the lip was a very natural one. It was not uncommon for the healing to be quite complete within from ten to twelve days. But it was a more extensive operation than the one described in the paper; it required more cutting. But all the cases did well. Malgaigne's operation could, moreover, be applied with perfect success to cases in which the disease extended from the mucous membrane downward nearly to the point of the chin. Even in such cases a complete mucous membrane could be supplied to the new lip.

Dr. Gallaudet rejoined that one of the advantages of Regnier's operation was its simplicity. It was so simple that anybody could do it, and that was one reason why he had desired to bring it to the attention of the society in order that through its transactions it might become known to less experienced operators than the gentlemen present. Malgaigne's operation required skill and experience.

## SUPPRESSION OF URINE AFTER OPERATION FOR REMOVAL OF RENAL CALCULUS; RELIEVED BY SALINE INFUSION.

Dr. McBurney presented a large renal calculus, and related the case as follows: A man, fifty years of age, came under his care a month previous, saying that he had suffered twelve years with pain, frequent attacks of colic, irritation of the bladder, acute attacks of fever, sweating, and symptoms characteristic of retention of pus within the body. The symptoms had become so aggravated that he submitted to an operation for renal calculus. The operation was done on the right side. The patient was not in very good condition, having become a confirmed morphine-eater, so that Dr. McBurney was anxious about undertaking what might prove to be an extensive operation, as it did.

In order to reach the kidney, a large, nearly transverse, lateral incision was made, the peritoneum was pushed out of the way, the kidney was entirely exposed, and a large calculus was felt. As the organ appeared to be healthy, he made an attempt to remove the calculus with as little injury as possible. An incision was made through the outer edge of the kidney, in the median line, and at right angles to the pelvis, uncovering the large calculus which formed a complete cast of the pelvis. In addition, there were various prolongations into the calyces which had to be broken off before the calculus could be dislodged. There were also several small separate calculi, but all were removed through the one section of the kidney. There was only moderate bleeding, no ligatures and no packing being required for its control. The question arose whether it would do to try to save a kidney which had been so long the seat of calculus. Inasmuch as the tissue looked quite well, and the danger to life in a feeble patient would have been much increased by extirpation of the kidney, it was decided to leave it. The patient had passed through the operation well; his color was good, the breathing was excellent, the pulse satisfactory. Yet during the next twenty-four hours nausea began; it was soon followed by vomiting, headache, and symptoms of uræmic poisoning. The pulse did not increase above 100, there was no particular pallor, no indication of hæmorrhage from any unrecognized point. There was suppression of urine. None was passed voluntarily, and only four drachms were obtained by catheter during the twenty-four hours following the operation. He wished to repeat that there was no indication of loss of blood; it was clearly a case of suppression of urine, and he had rather expected to lose his patient, but decided to try a large infusion of salt solution, fully recognizing that he had not to deal with a case of hæmorrhage. A quart was injected into a vein of the arm, the immediate effect was that usually observed. The pulse became fuller, the color better, the patient became able to respond intelligently to questions. Within the next twenty-four hours he passed thirty-four ounces of urine, and on the following day passed seventy ounces. There had been no further interference with the kidney function and the patient had steadily recovered.

Dr. McBurney said that of course he did not present the case as proving the value of saline injection in suppression of urine, yet the result had been such that he would like to see it tested further by those who might meet with similar cases.

Dr. H. Lilienthal had been very much impressed with Dr. McBurney's experience with salt solution in suppression of urine, as it had happened to him to witness a similar occurrence that very day. On the preceding day Dr. Elsberg, house surgeon at Mt. Sinai Hospital, had operated upon a woman for strangulated hernia, in the course of which he had resected two or three feet of gut and had made anastomosis with Murphy's button. The patient was in fair condition at the completion of the operation, but there developed thereafter total suppression of urine. Only a few drops were obtained, which solidified on boiling. About twenty-four hours after the operation Dr. Lilienthal, although the case was not in his ward, suggested saline infusion, and it was immediately made. The patient at once came out of her comatose state, and there was striking improvement. He could not say what would be the termination of the case, but he still feared the patient would die.

Dr. Abbe said that Dickinson (*British Medical Journal*), five or six years ago, had called attention to the fact that patients could be aroused from diabetic coma in a few minutes by saline infusion, and that the mind was rendered sufficiently clear to enable them to transact business. He had suggested that this fact might be of some medico-legal interest, and that the injections might be repeated several times if necessary.

## ENTERO-CYST OF THE BUTTOCK.

Dr. Lilienthal presented a specimen of this nature, a full report of which he proposed to publish later.

## FIBROID OF THE UTERUS, WITH PAPILLOMA OF THE OVARY.

Dr. L. S. Pilcher presented two specimens removed from the same patient, one being the uterus containing a fibroid tumor, the other a typical papilloma of the ovary. The patient, forty-seven years of age, had for five years suffered from a varying degree of pelvic distress, with occasional inability to empty the bladder because of something pressing upon it. During the past year she had been aware of the presence of a tumor within the abdomen. Quite recently she had come under his observation, and he was able to recognize on palpation a peculiar lobulated tumor within the abdomen and pelvis. One portion of the tumor was felt crowded into the left side of the pelvis; the other portion rose higher in the abdomen. There were all the signs of a fibroid of the uterus, and he began his operation with that diagnosis. On making abdominal incision, the pelvic growth was found to consist of a uterine fibromyoma, which was removed with the uterus. The abdominal tumor was recognized as an independent tumor, springing from the right broad ligament by a narrow pedicle. Upon removal it proved to be an exceedingly fine specimen of papilloma of the ovary. Upon its under surface the capsule had already become perforated, and papillomatous material had become distributed to some extent throughout the abdominal cavity. The tube and egg-bearing portion of the ovary could be seen upon one portion of the tumor. The growth had developed from the hilum of the right ovary.

Dr. Pilcher added that this was the third specimen of papillomatous cyst of the ovary which had come under his observation within the past few years. The first one was comparatively small, the second one as large as a fœtal head, as was also the one presented, but the papillomatous material had not penetrated the capsule, and he was pleased to be able to say that there had been no recurrence. The ascites, which was usually caused by irritation of the papillomatous growth upon the peritoneal surface, was not sufficient in the present case to attract attention previous to the operation, nor to interfere with the removal of the tumor.

*Stated Meeting, April 10, 1895.*

The President, Robert Abbe, M.D., in the Chair.

## SARCOMA OF KIDNEY; NEPHRECTOMY; CURE (TWO CASES).

Dr. R. Abbe presented for further observation the two children whom he had shown at a former meeting (Annals of Surgery, January, 1894) in illustration of the results of operative treatment of sarcoma of the kidney. Case I, a girl now aged five years, operated upon April 12, 1892, or three years ago. Removal of large sarcomatous kidney, two and a quarter pounds. Patient then cachectic, pallid, exhausted. Present condition one of good health; no sign of return of tumor. On careful physical examination scar firm; no tendency to hernia. The president had observed that it was the rule in transverse section through the abdominal parietes for the wound to heal with firm scar and leave no tendency to hernia.

The same remarks applied to the other case, a child operated upon November 20, 1892, when fourteen months of age, the sarcomatous kidney weighing seven and a half pounds, or just one-half the weight of the child, which was fifteen pounds after operation. Two years and a half have elapsed; the child is strong and well and the picture of robust health. No sign of tumor can be discovered. The scar is firm and perfect.

Dr. W. B. Coley said he had done nephrectomy for large sarcoma of the kidney in a girl of five years, last September. She was still in good health, without any signs of relapse.

Dr. C. K. Briddon said with regard to these cases of sarcoma apparently cured by nephrectomy that the operation had only of recent years come to be regarded as a proper one, and he believed all English surgeons, even up to Mr. Tait, had doubted its utility. The Germans, however, seemed to have advanced beyond that point, yet he was sure that in the minds of a good many surgeons there was still a certain amount of doubt as to the propriety of doing nephrectomy for sarcoma of the kidney. The cases presented by Dr. Abbe appeared to illustrate very well the propriety of the procedure. He had never before seen cases where the patients had survived for so long a period. There was good reason to hope the disease would not return in the future.

He would be glad if Dr. Abbe could inform the members of the society if there was any way of determining why one patient operated upon was likely to be permanently cured, while another in apparently the same condition would have relapse. He thought that was a very important matter to decide. Not that he was questioning the propriety of nephrectomy in any case of sarcoma of the kidney, but it would enable us to give a prognosis for the future, and he thought it was possible that with the amount of experience which Dr. Abbe had had he might be able to throw some light on the question.

Dr. B. Farquhar Curtis remarked that lately the question had been raised as to the propriety of leaving the fatty capsule of the kidney in these cases. It had been stated that infection spread from the kidney to the capsule. He inquired of Dr. Abbe whether the capsule had been removed with the kidney in his cases.

Dr. F. Tilden Brown said that recently a case had been reported in which there was relapse three years after operation. It would be remembered that Wagner had concluded from statistics that if there was no relapse after two years the case could be regarded as cured. He inquired whether there had been hæmaturia in the cases presented.

Dr. Abbe replied that in one of these cases there had been a trace of albumen, but no blood; in the other nothing abnormal. In both the kidney was shelled out of the fatty envelope, no attempt having been made to remove the latter. In one, the larger tumor of the two, part of the kidney was healthy and was not removed. (See ANNALS OF SURGERY, January, 1894.) There was nothing about the cases which would indicate that there was less likely to be recurrence than in others in which recurrence had actually taken place. In fact, he had entertained doubts about the older case, as two mesenteric glands were felt at the time of the operation, which could not be removed, but they had since melted away. Both specimens were round-cell sarcomas, one containing a good deal of unstriped muscular tissue. In a third case which he had reported a year ago there had been recurrence after five months. A physician in a neighboring city had then used the toxines of erysipelas without benefit. The tumor progressed, and the child died eight months after nephrectomy.

## LATE RESULT OF REMOVAL OF THE TONGUE FOR SARCOMA.

DR. F. W. MURRAY presented a woman, fifty-six years of age, who, in April, 1894, was admitted to his service at St. Luke's Hospital. Five years before her physician had removed from the floor of the mouth a cyst, which was said to be a ranula. This cyst was on the right side close to the jaw and, probably, bore no relation to her later trouble. In December, 1893, a small hard lump the size of a hickory nut was removed from the floor of the mouth, right side, close to the tongue. It had existed but a short time, was growing rapidly, and on account of increasing pain was removed. On microscopic examination it was pronounced to be an endothelioma. Shortly afterwards it recurred in the scar of the previous operation and spread rapidly to the tongue. The patient was in fair condition on admission to the hospital, but was rather anæmic. The tumor was firm, indurated, and painful on pressure, and bled freely when pricked with a needle. It involved the floor of the right side of the mouth, the greater part of the right half of the tongue, and the left half to a small extent. The tongue was tied down and incapable of being protruded from the mouth, thus interfering with speech. She complained of attacks of acute pain in the tongue and radiating from there to the ear, and aggravated by attempts at chewing or swallowing solid food. There was constant salivation. The submaxillary gland was enlarged and tender. There was no ulceration at any point. A few days after admission the entire tongue, the floor of the mouth, and right submaxillary gland were removed in one mass according to Kocher's method. The right lingual artery was tied in the wound, the left through an independent incision in the neck, and tracheotomy was performed just previous to making the Kocher incision. There was but little hæmorrhage, and the patient stood the operation well. The wound was packed with iodoform gauze. For four days after operation nourishment was administered by the stomach-tube and *per rectum*, after that by the tube alone. The patient was out of bed on the sixth day, the tracheotomy tube was removed at the end of a week, and on the fourteenth day the patient commenced to swallow soft solids. Convalescence was uneventful, but the wound, owing to its large size, required some time to heal. Patient was discharged five weeks after operation with wound healed and in good condition. A small strip of the root of the tongue about one-eighth of an inch wide was unintentionally left, and it can now be seen stretched out owing to the contraction of the tissues following the healing of the wound. At the present time, over a year after the operation, there has been no recurrence, and the patient enjoys good health. She articulates fairly well and takes solid food and only complains of increased salivation, which, while less than before operation, still remains. There has been no impairment of the sense of taste and she enjoys her food. Microscopic examination of the tumor revealed that it was a round and spindle-celled sarcoma. The result is a good one from the fact that a year has elapsed since operation, which was performed to remove recurrence.

## LARGE CONGENITAL HERNIA OF THE UMBILICAL CORD TREATED MECHANICALLY.

Dr. Coley presented a child whose case he had mentioned in his paper read at the January meeting. At birth there was an umbilical hernia the size of a quart measure. Under mechanical treatment by strapping with adhesive plaster and bandage the tumor had been reduced to small size. Hernia of the cord is very rare and the prognosis not favorable.

## PROBABLE LUMBAR HERNIA.

Dr. W. B. Coley presented a case of probable lumbar hernia operated upon by Dr. W. T. Bull over a year ago. At the time of the operation the child was a year and nine months of age. The tumor was then very near the triangle of Petit, though a little too far anterior, yet it was thought to be really lumbar. The sac was opened and removed entirely, and the wound was closed in two layers, using kangaroo tendon for the deeper sutures and catgut for the skin. Somewhat over a year had elapsed and there was no evidence of recurrence.

DR. B. F. CURTIS remarked upon the case of lumbar hernia presented by Dr. Coley that he had seen the child two or three times, and had observed that during the six months preceding the operation the hernial tumor had become considerably smaller, the opening, it seemed, getting smaller as the child grew. He believed that no distinct ring could then be felt, and he would like to know from Dr Coley whether at the operation a distinct ring was found, and whether the hernial coverings were the ordinary thinned-out layers of the abdominal walls.

DR. COLEY said the child was treated by rubber plaster and bandaging a considerable time, but as they saw no improvement Dr. Bull decided to operate. The operation disclosed a distinct peritoneal hernial sac which had to be dissected out, and a very distinct hernial ring, easily admitting the thumb.

## THE RADICAL CURE OF VARICOCELE.

DR. F. W. MURRAY read a paper, "The Radical Cure of Varicocele." (See page 99.)

DR. R. H. M. DAWBARN commented upon a remark of Treves, that he had never been able to feel the spermatic artery during the open operation for varicocele. In every operation done by Dr. Dawbarn he had been able to feel this artery with a good deal of ease. Treves had also stated that it was of no importance whether it were tied or not.

DR. LILIENTHAL said he had done the open operation several times, and, while he had been able to feel the spermatic artery, he had not been able to isolate it, but had always tied off the entire pampiniform plexus, as he believed Treves also had advised. He asked Dr. Murray whether he had observed thrombosis or atrophy in his series of cases.

DR. MURRAY said he had not seen thrombosis. As to atrophy, there had been one case in which the testicle was apparently smaller after the operation than before, but he thought the impression that there had been atrophy was deceptive, for, usually, the varicose veins made the testicle appear larger than it really was. Regarding recognition of the spermatic artery, in all the cases he had felt an artery of some size. As to the danger of gangrene of the testicle from ligating the spermatic artery with the veins, there was such free anastomosis of the vessels of the scrotum that he thought there was little danger unless all the veins were included in the ligature. In Bennett's operation the pampiniform plexus alone was included in the ligature, but there were one or two vessels left at the back of the scrotum which carried the blood away.

## PIN IN THE APPENDIX VERMIFORMIS.

Dr. F. Kammerer presented a specimen from a case of appendicitis, caused by the presence of a pin. The patient was a boy of seven years, who gave no history of previous attacks. He had been ill for almost a week before admission to St. Francis's Hospital. The diagnosis was supported by the presence of a tumor on the right side, which could be plainly felt by external bimanual palpation. Upon incision of the abdominal cavity, the tumor was seen to be in the omentum, circumscribed, about as large as an egg, and not at first giving the impression of inflammatory infiltration. After separating some adhesions, it was found that the distal half of the appendix was firmly embedded in the mass, and further, that an ordinary pinhead had passed through almost the entire length of the appendix and had escaped through a perforation at the tip of the latter. There were very firm adhesions of the appendix to the omentum, showing that this could not have been the first attack. The cases in which a pin had entered the appendix and caused trouble were not so rare as the speaker had at first believed, Drs. Markoe and McBurney having each presented one to this society, and only a few weeks ago two additional cases were reported in the *Medical Record*. It was the first foreign body the speaker had ever found in quite a number of extirpations.

Dr. Abbe said he had also had a case of pin found in the appendix which he had not reported to the society. The pin was crusted with calcareous matter. It was the only case of appendicitis in which he had found a foreign body other than fæcal concretions.

# EDITORIAL ARTICLES.

## ON THE CAUSE OF DEATH AFTER BURNS.

The various theories of the cause of death following burns have lately been enriched by that proposed by Welti,[1] who regards thrombosis in the brain, stomach, and kidneys produced by the heating and swelling together of the blood-disks, and the alteration in the vessels caused by this thrombosis, some of the vessels being constricted while others are dilated.

This theory is also supported by Silbermann,[2] who, however, ascribes the greatest influence to the alteration in the blood-corpuscles, and who also says that the thrombi are most numerous in the pulmonary vessels and lead to emptying of the right heart.

Salvioli[3] has studied this subject anew, and finds that the blood-disks do form white thrombi in the burned area and that their conveyance to distant parts produces emboli. There is also well-marked narrowing of the arteries and a change in the red corpuscles, which become pasty. When dogs are subjected to repeated bleeding until their blood has become very poor in corpuscles, it is found that they will bear very large and severe burns without fatal results, for the reason that the formation of thrombi and emboli does not occur.

Kijanizyn[4] found in the blood, internal organs, and urine of patients a toxic substance which was best obtained by Brieger's methods. This ptomaine was an amorphous body of yellowish or yellowish-brown color and of a penetrating, offensive odor, soluble in water and alcohol, slightly so in chloroform and benzine, and insoluble in ether. Moderate solutions injected subcutaneously produced in animals apathy, somnolence, diarrhœa (at times bloody), vomiting, and reduction of the temperature. The author declares the severe symptoms following a burn of great extent to be due to this poison and also to the affected condition of the kidneys, and other parenchymatous organs through the formation in them of thrombi and the subsequent degeneration.

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[1] Ziegler and Nauwerk's Beiträge, Band IV.

[2] Virchow's Archiv, Band CXIX, Heft 3.

[3] Virchow's Archiv, Band CXXV, Heft 2; Monatsh. für prak. Derm., Band XVI, No. 6.

[4] Wratsch, 1891, No. 16; Monatsh. für prak. Derm., Band XVI, No. 16.

Lustgarten[1] considered that the fatal result was produced by a ptomaine developed in the necrosed coagula and absorbed into the system, and points to the fact that deep burns with charring of the tissues are relatively less apt to be fatal than incomplete burns, for the reason that putrefaction can only occur in the latter. This ptomaine he considers to be a substance analogous in its effects to muscarine, acting on the vagus and especially on the gastric plexus, and on the cerebral cortex producing vomiting, narrowing of the pupil, etc. From the physiological antagonism between muscarine and atropine this latter drug would be indicated, and Lustgarten reports one case of recovery in which vomiting had already occurred, but which totally ceased after five milligrammes of atropine had been given subcutaneously. Locally drying and absorbent dressings are indicated, such as magnesia with an antiseptic in order to inhibit the development of the putrefactive process, and if no contra-indication exists, even the removal of the necrosed tissue by surgical means.

Reiss[2] contributes the results of his studies on this subject in an interesting article. He refers to the numerous observations lately made and the new theories put forward and reviews the principal ones. Regarding Welti's he says, "This theory will not stand the test for the reason that Welti only observed these changes a long time after the death of the animal experimented on, so that these changes were in all probability post mortem."

Reiss then continues, "None of these theories take into account the effect on the organism of substances created by the destruction of animal tissue at comparatively low temperatures and which creates toxæmia by their absorption." As it was impossible to obtain the blood of patients for examination as to the nature of these toxic substances (which would, he thinks, undoubtedly have given the best results), he undertook the examination of the urine. These investigations were carried out in five patients (four with fatal termination), all of whom had more or less anuria.

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[1] Wien. klin. Wochens., 1891; New York Medical Record, August 8, 1891.

[2] Archiv für Dermatologie und Syph., 1893; Ergänzungshefte I.

A subcutaneous injection of one cubic centimetre of normal urine in white mice caused no pathological symptoms whatever, but the same quantity of urine of one of these patients produced a soporific condition, soon passing into coma and followed in a few hours by clonic spasms of the trunk and extremities, and death. Repeated attempts always gave the same results, though sometimes death did not occur until the second day. In one mouse this fatal result occurred after only five divisions of a Pravaz syringe, showing that death was not produced by a heightened pressure in the system from the introduction of a large quantity of fluid.

Reiss next endeavored to ascertain whether this toxic substance was of nitrogenous or non-nitrogenous origin, and to this end studied the effect of various nitrogenous and non-nitrogenous substances. Fifteen grammes of cellulose were heated in a tube, the product mixed with a feeble salt and carbonate of soda solution, and then injected into an animal, but without any pathological result. Five grammes of serum albumen were then treated in the same manner, and after the injection of from three to five divisions of a Pravaz syringe, the same results were obtained as when the urine of patients suffering from burns was injected; these results sometimes coming on after an interval of only a few minutes. The experiment was repeated on guinea-pigs with the same results, showing, therefore, that the toxic substances were nitrogenous.

The urine of these patients was then subjected to an analysis. The odor of this urine was a peculiar one and reminded of pyridine, and this odor was especially marked after adding a small quantity of liquor potassa and distilling. Three extracts, with alcohol, with water, and with ether were then made from this urine. Of these three the watery extract was moderately toxic, the ethereal only indifferently so, while the alcoholic showed itself to be the most poisonous of all; in mice death rapidly followed the injection of two to three divisions of the syringe, but upon heating and cooling this extract its toxic property rapidly decreased, showing that *the* toxic substance was volatile in character; this was also found to be the case with the nitrogenous serum albumen used as a control.

Believing that the toxic substance was an empyreumatic body belonging to the pyridine or chinolene group, he, by a complicated process, obtained from this alcoholic extract a clear fluid, which, when injected into animals, produced the same results as did the injections of the alcoholic extract and the serum albumen.

In order to study the chemical nature of this fluid better chloride of platinum was added to it, as this forms with pyridine a double salt. After evaporation in a vacuum, an orange-yellow, crystallizable body was obtained, which, dissolved in water, was without odor, but on the addition of liquor potassa gave forth the odor of pyridine. This salt had a melting point of 240° C., the same as the double salt of platinchlorid-pyridine. The Berlin blue test showed it to contain nitrogen.

Pyridine may be obtained by the dry distillation of organic nitrogenous substances. It is found in large quantity in the so-called bone oil (oleum animale, Dippel) and may also be obtained from coal-tar. Of late it has been produced synthetically. The most important representatives of these bases are pyridine ($C_5H_5N$), picoline ($C_6H_7N$), lepidine ($C_{10}H_9N$), lutidine ($C_7H_9N$), and parvoline ($C_9H_{13}N$). To these may also be added those insoluble in water, of the group of chinolene ($C_2H_7N$).

According to the experiments of Harnak and Meyer the action of this group on rabbits is an irritation of the convulsive centres in the spinal cord, resembling very much the action of nicotine. As other centres of the medulla—*i.e.*, the vagus—are not affected, it differentiates its action from that of picrotoxine. The pyridine bases have also an action on the motor centre of the cord and on the intermuscular nerve endings.

Reiss's observations with pyridine and also with this substance obtained from patient's urine, on animals, were identical and as follows: In all animals injected with the obtained substance there was observed a high degree of anuria; this could be produced in dogs by three to five divisions of a Pravaz syringe of the preparation, and by a syringe full of picoline; while guinea-pigs required only one and a half divisions of the syringe of picoline, or lutidine, to produce the same effect. The anuria lasted in dogs from twenty-four to thirty-six hours; in guinea-pigs much longer, especially after picoline. Further, in these latter, vomiting occurred, especially towards the end, when the injected material was producing its lethal effect. Somnolence followed by coma was also produced.

In white mice the injection of this obtained substance was followed by necrosis of the tissues around the point of injection, and this also occurred when the urine of patients was employed, but necrosis did not occur when normal urine was employed. In dogs, likewise, on the second day, a necrotic fistula followed the injection of patient's urine or of the obtained substance.

The phenomena following burns, especially such as have a fatal termination, are then the same as after poisoning with pyridine,—viz., somnolence, anuria, vomiting.

Reiss then raises the question if the cause of death following all burns is to be attributed to the formation of pyridine. In such cases where death is the result of a very high temperature, causing roasting of the tissue in contra-distinction to boiling, as from boiling water, the pyridine is probably produced by the high temperature. In the latter case he argues that the pyridine may and probably is produced at comparatively low temperature by synthesis.

Another observation was made at autopsies where examination of the internal organs usually failed to reveal any pathological changes, and that was, that the expressed juice of such organs as the liver, kidneys, and spleen had a peculiar empyreumatic odor, reminding, however, more of animal oil than of pyridine.

From these observations he draws the conclusions that the symptoms in fatal cases not due to shock or to some complication, as septicæmia, are probably produced by the action of pyridine or animal oil or some analogous substance, and this view is, he thinks, strengthened by the fact that as patients show symptoms of improvement the quantity of this empyreumatic substance becomes increased in the urine, showing that the kidneys are straining it off from the system ; while in those going on to a fatal termination the quantity in the urine remains small.

From these conclusions he would suggest the following therapeutic measures: As antagonizing or neutralizing substances to pyridine are unknown, measures adapted to free the system as quickly as possible should be employed. To this end venesection followed by infusion of salt solution and the ablation of the necrotic mass surgically to prevent absorption are indicated. These measures would have to be instituted early, before the advent of vomiting and somnolence, as Hebra's and Kaposi's vast experience have led them to make the statement that no case ever recovers after these symptoms have appeared.

In conclusion he states that he would not be understood as regarding all fatal cases as due to the action of these empyreumatic products, but only such as are not due to shock, sepsis, or other complication.

George Dederic Holsten.

# INDEX TO SURGICAL PROGRESS.

## ABDOMEN.

**I. A New Intestinal Suture.** By Dr. EMMERICH ULLMANN (Vienna). A good method of intestinal suturing must fulfil two conditions; it shall insure a certainty that the suture will hold, and it shall be quickly applied. For a long time surgeons strove to accomplish the first condition, and as a result the Czerny-Lembert suture was evolved. Then failures were found to be due to the long duration of the operation. To overcome this a rapid circular suture of the resected intestine was practised, and such devices as the button of Murphy were invented. It has seemed to Ullmann that in these devices certainty has been sacrificed to quickness, and he has sought to find an operation combining the two essential conditions of perfection, and in which the whole operation can be carried out in a few minutes.

The method which he has adopted was first theoretically suggested by an Australian physician, Wydenham Munsell, but first performed by Ullmann upon a patient in December, 1894, after having practised it upon the cadaver and living animals. He has modified the operation so that it is done as follows:

A fixation suture is passed through the whole thickness of both of the divided ends at the insertion of the mesentery, the knot being tied on the inside. (Fig. 1, *b d*.) The same is done on the opposite side (*a c*), and then on the two lateral sides (*e f* and *g h*). Then with a cut of the scissors a longitudinal opening, five or six centimetres long, is made on the side opposite the mesentery in the afferent end of the intestine. Through this opening a pair of forceps is passed and the sutures grasped and drawn up. As this is done, the proximal end of the intestine becomes inverted and drawn through the wound.

(Fig. 2.) With this comes the distal end, so that both ends of the intestine are drawn through this opening (*m n*). The mucous membrane of the efferent end looks inward, and that of the afferent end looks outward. Between the two mucous membranes the peritoneum lies upon peritoneum. The four sutures are then drawn up and tied, dividing the circumference into four segments, so that the application of the other sutures is very easy. Two sutures can be applied at the same time by passing a needle straight through the four walls at a time, cutting in the middle and letting an assistant tie one side while the surgeon ties the other. These sutures are naturally tied on the inside, and the ends are closely cut. After the application of this series of interrupted sutures, the invaginated gut is drawn out again.

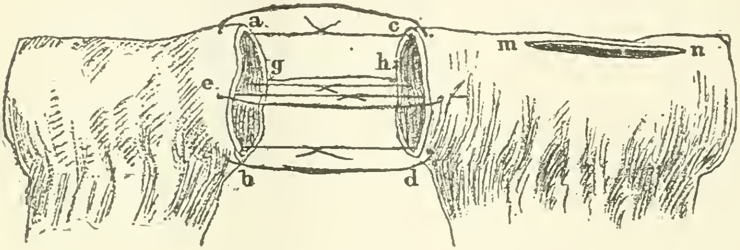

FIG. 1.

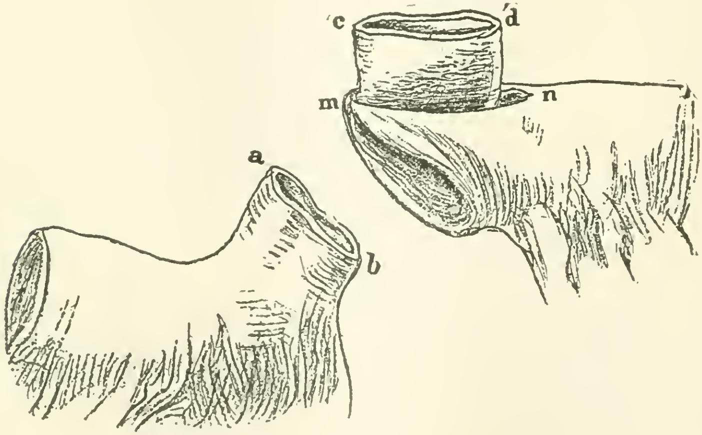

FIG. 2.

The longitudinal opening is then closed. Silk is used in the operation. The danger of invagination is prevented because the distal end is sewed into the proximal end.

Ullmann has performed this operation upon a woman, twenty-seven years of age, in whom he resected 174 centimetres of colon for carcinoma. The abdomen was closed without drainage. The wounds healed primarily without any disturbance.

He hopes that this operation will come into general use. Many will hesitate to adopt it because one simple row of sutures is used; others, because the sutures include all three of the coats of the intestine. To the first it may be said that a second series of sutures may be applied to the serosa after the gut has been drawn out. This is certainly not necessary according to Ullmann. He lays great importance upon the fact that corresponding parts of the intestine are accurately brought together. In the other operations there is always some part that is more relaxed than the rest. As to the second objection, he claims that it makes no difference whether the mucosa is included in the suture or not. If the surgeon does not wish to include it, he can pierce only the muscularis and serosa, for the field of operation is so plainly in view and so perfectly under control that the mucosa can easily be omitted from the suture. It certainly seems that the second

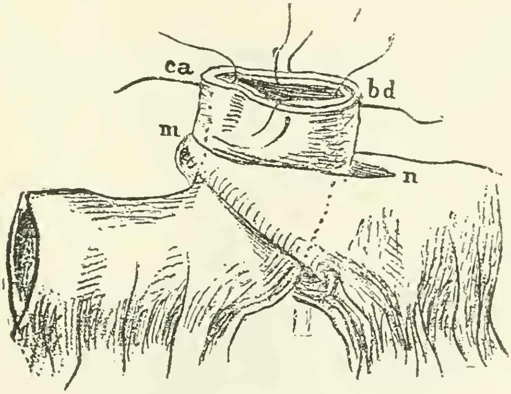

FIG. 3.

objection is well taken. If the operation, as Ullmann performs it, stands the test of time, we shall have learned something in abdominal surgery and seen another of the bugaboos of infection disposed of.—*Centralblatt für Chirurgie*, No. 2, 1895.

**II. A Contribution to the Technique of Intestinal Suturing.** By Dr. Landerer (Leipzig). The numerous recent modifications of the intestinal suture show the desirability of simplifying the operation. In strangulated gangrenous hernia, as well as in the resection for cancerous disease, the entire result may depend upon the perfection of the anastomosis, whether the operation takes ten minutes or an hour. In the case of feeble patients, a prolonging of the narcosis and the operation for half an hour may be the cause of death.

Of the many modifications of the intestinal suture (Neuber, Senn, Wölfler, Braun, Von Baracz, *et al.*), the button of Murphy seems to attract the greatest interest at the present time.

Although many good results have been reported in America and also in Germany, still, there have been some cases in which the button caused perforation and fatal peritonitis or intestinal obstruction. In the Annals of Surgery, of February, 1895, Dawbarn reported two cases of death from the use of Murphy's button, once from perforation and once from intestinal obstruction. He has also reported four cases in which the button was not passed along the canal, but was found in the intestine at the autopsy or at a second operation.

The objections to this button are its size and weight, which hinder its easy expulsion and passage along the intestinal canal, and the necessary necrosis of the clamped portion of intestine which renders perforation liable to occur. Another objection is that it is not always at hand and not easily obtained.

Landerer has invented the following method of quickly uniting the two ends of divided intestine without the dangers and objections inherent in this button of Murphy. As yet he has tried it only upon dogs and cadavers.

A cylinder is cut out of a potato or turnip. This cylinder is perforated by a hole made with a canula or grooved chisel, is bevelled at either end and traversed about its middle by a circular groove. (Fig. 1.) This groove is one centimetre to 1.3 centimetres long, and one-half centimetre to one centimetre deep. It is in shape very like

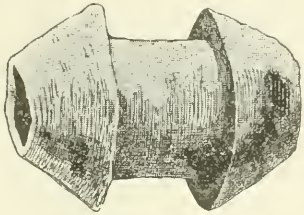

Fig. 1.

the bone cylinders of Neuber. These cylinders are made in various sizes before the operation and disinfected in sublimate solution 1 : 1000.

The two ends of intestine are brought over this cylinder. The

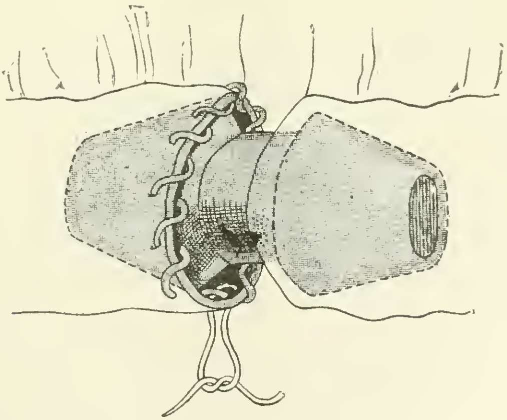

Fig. 2.

intestine is first fastened by a running suture passed through the intestinal wall over and over the edge of the gut. (Fig. 2.) The two ends of the loosely-applied suture must be crossed at the place of tying or a little puckering will result, through which intestinal contents can pass. In Landerer's first two cases a small fæcal abscess formed at this place. It was shut off and did not interfere with recovery. The suture need not be applied so near the end of the gut as is shown in Fig. 2, but more of the intestinal wall may be included. It may be inserted three to five centimetres from the edge. Landerer begins this running suture at the point opposite the insertion of the mesentery, and allows the threads to cross before tying. If the knot is made on the side towards the mesentery, irregularities are less easily discovered. With the help of this suture—as with the tobacco-pouch suture used with the Murphy button—the intestine is pushed over the cylinder so that it rolls into the groove, and the suture drawn up like a shir-string and tied; and its serous surfaces come together. In some cases it has sufficed to apply simply a single suture at the mesenteric insertion to prevent the gut from pulling apart. Healing in these cases was perfect. A few interrupted sutures or a running sero-serosa suture may be applied. These sutures are applied very easily because the surfaces are held nicely in position by the underlying cylinder. It suffices to apply simply a serosa suture at the mesenteric insertion and one on the opposite side of the intestine.

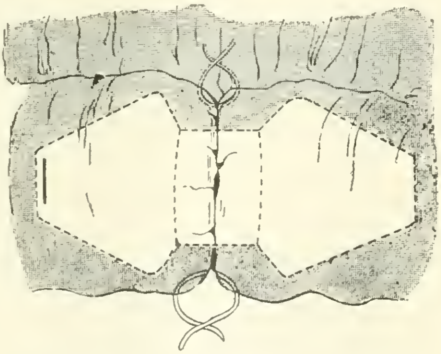

Fig. 3.

The canal through the cylinder should be five to eight millimetres in diameter. In dogs, Landerer used a canal three to four millimetres in diameter. In dogs which were killed on the third or fourth day there was no fæcal accumulation found either above or below the cylinder, as has been often found in the cases where Murphy's button was employed. The fæcal current evidently circulated freely through the cylinder.

At the third or fourth day the cylinder was found to be just as firm as at the operation, though its ends and lumen had begun to show that it was being digested away. It can be assumed that the vegetable cylinder remains in place five or six days, which is abundant time for strong adhesions to form. After eight or ten days the cylinder could not be found anywhere in the intestinal tract nor in the fæces which had been previously passed. It had been completely digested. At this time only a linear scar remains, and there is nothing like a sign of stenosis to be found.

The animals experimented upon by Landerer were not nursed, but on the following day were given their ordinary food. The operation is more difficult in dogs than in men, because in the dog there is a very strong tonic contracture of the circular muscles of the intestine, which causes the mucous membrane to extrude and makes the operation difficult. But still Landerer has obtained good results, with no other serosa suture than one at the mesenteric insertion. When the mucosa protrudes too much, a circular piece can be cut off.

In the large intestine larger cylinders must be used. From experiments upon the cadaver Landerer finds that the operation is entirely applicable for gastro-enteroanastomosis and for resection ot the pylorus. Here the cylinders must be shorter.—*Centralblatt für Chirurgie*, No. 13, 1895.

James P. Warbasse (Brooklyn).

**III.—Excision of Non-Cancerous Strictures of the Rectum through an Incision in the Posterior Vaginal Wall.** By M. Campenon (Paris). The tendency of surgeons at the present time is to excise strictures of the rectum. An endeavor is always made to preserve, if possible, the external sphincter. This is the aim of the operations devised by Kraske and by Hartmann. The operation of the latter surgeon is not applicable in all cases; and if we are to believe the recent thesis of Morestin, the operation of Kraske has not given any very remarkable results.

M. Campenon has been led to propose another way in the female. His patient was a woman, twenty-six years of age, suffering from a stricture of venereal origin, situated at the ano-rectal end of the gut. Its upper border could not be reached by the finger. The operation was as follows: The patient was placed in the dorsal decubitus, just as for a vaginal hysterectomy, a retractor supported the anterior vaginal wall, and he then divided by transfixion the entire recto-vaginal septum. The two valves thus made were held aside by his assistants, by means of silk threads passed through each side. Through the extensive field of operation which was thus exposed he was able to excise the strictured portion of the gut, which was first freed above and below by two transverse incisions. The upper end of the gut was then brought down and fastened by two rows of sutures; the sphincter was restored by four interrupted sutures, and the operation was finished by an ordinary perineorrhaphy. The result was good, there were no complications, and the patient was discharged on the fifteenth day as cured.—*Transactions of the French Congress of Surgery*, 1894.

H. P. DE FOREST (Brooklyn).

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# THE SURGICAL TREATMENT OF CERTAIN FORMS OF BRONCHOCELE, WITH REPORTS OF SIXTEEN CASES.[1]

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THE surgical treatment of bronchocele has always excited great interest among surgeons, but it is only since the introduction of antiseptic methods that surgeons have been able to perform operations on tumors of the thyroid with any measure of success.

The continental surgeons, especially those of Switzerland, where disease of the thyroid is so common, have done much to perfect our methods in the surgical treatment, and to such men as Socin, Reverdin, and Kocher much credit is due. My experience in the surgical treatment of bronchocele has been small compared with that of these men, who count their cases by the hundreds; but, although the number of cases operated on by me only reaches sixteen, still, I have learned something, and this is my excuse for inflicting a paper upon you.

The method I have adopted is that of enucleation or "shelling out," and the more experience I have the more I am convinced that this is the true method to practise in all cases of encapsulated or cystic tumors of the thyroid, and these are seen infinitely more commonly than the diffuse or angiomatous forms. In fact, nineteen out of twenty cases of diseased thyroid, and perhaps more, can be treated in this way.

This method of operating was adopted first by Juillard, Rottman, and others, but to Professor Socin belongs the credit of first systematizing the operation and bringing it prominently before the profession. The advantages of this procedure are many: first, the rapidity and comparative bloodlessness of the operation; second, the fact that only the diseased portion of the gland is removed, so that no danger of serious after-results, such as cachexia strumipriva, need be feared; and, thirdly, the comparative safety of the method and the absence of the risk of wounding the recurrent laryngeal nerve.

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[1] Read before the Ontario Medical Association, June 5, 1895.

I have not as yet operated on any of the enormous goitres, which are seen so commonly in Switzerland and occasionally in French Canada, for I have never been able to induce such cases to submit to operation, as I could not promise that it would be entirely without danger. However, I have operated on cases of considerable size, where the growth extended over the vessels at the root of the neck and beneath the clavicle. In several cases the tumor reached from the hyoid bone to the clavicle and went well past the middle line of the neck.

The most favorable cases for operation are those in which only one side of the gland is affected, for in such cases the enlargement is most likely to be of the cystic variety. Of course, all enlargements or tumors of the thyroid are not suited to this form of treatment. For instance, all those cases of diffuse enlargement of the gland, malignant and inflamed goitres, as well as those vascular bronchoceles associated with Graves's disease, need either to be treated by exsection or ligature of the thyroid arteries. In the diffuse form Kocher has obtained good results[1] by feeding with thyroid extract.

In many of these cases the enlarged gland has been greatly diminished by the administration of twenty drops of tincture of iodine, three times a day, a treatment advocated by Condet, of Geneva, nearly seventy-five years ago. Again, Professor Kocher has seen these diffuse enlargements disappear almost entirely or sensibly decrease by the patient remaining in hospital without any treatment at all.

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[1] Correspondenz Blatt für Schweizer Aerzt, January, 1895.

The enlargements of the thyroid to which I allude as suitable for treatment by enucleation are the cystic and colloid forms,—the latter is usually encapsulated, though the capsule may at times be of the thinnest. The fluid tumors usually contain a dark yellowish-brown material, which on microscopical examination shows large numbers of cholesterine crystals, and large round cells containing fatty globules. Sometimes the color of the fluid is light yellow and glairy in consistency, and other times the fluid is very dark in color, containing coffee-grounds-looking material, due, no doubt, to hæmorrhages.

In the solid tumors the material is mostly colloid and almost colorless. On microscopical examination it is found that the solid and semisolid tumors have a distinct fibrous capsule, and are composed of vesicles filled with colloid matter, and these vesicles are usually lined with cubical epithelium. There is often evidence of the coming together of vesicles by atrophy of the intervening wall. The cyst wall is often made up of several layers between which atrophied gland tissue is found. The cystic forms, which are by far the most numerous, were formerly treated by injections, setons, and even incisions.

Mayo Robson,[1] a few years ago, in a paper on "Cysts of the Thyroid," advocated antiseptic incision and stitching the edge of the cysts to the skin, scraping out the interior of the cysts and draining, and after-packing with zinc lotion and lint.

He reported two successful cases treated in this way. Injections were always dangerous, and severe phlegmonous inflammations often followed; setons frequently led to septic infection, and both forms of treatment were very uncertain.

These cases are much better treated by enucleation, as recommended by Socin. The operation can be made aseptic, and usually only requires the skill which a general surgeon, used to various operations, easily acquires.

All cases, however, are not simple, and any one who has operated often will occasionally come upon a difficult case, and for this he must always be prepared; the most simple cases often proving most troublesome from unexpected hæmorrhage, etc.

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[1] Lancet, January 22, 1887.

In the cases I have operated on there has been no mortality, the great majority recovered and went out of hospital within a week.

The simplest cases for operation are those where the cyst is single; where there are several cysts which are situated in both lobes, then the difficulties increase, for after enucleating a large cyst or solid tumor one frequently finds there are several others deeper down, which can only be reached by cutting the posterior wall of the cavity from which the last one has been taken. This occurred in Cases IV, IX, and XII.

Again, in some cases the cyst wall is so thin and friable that it cannot be enucleated, but has to be picked off, piece by piece, each tearing of the sac opening up large veins, which bleed furiously, such a case I had in No. XI, and to stop the hæmorrhage I had to tie the inferior thyroid artery and vein. In other cases the cyst wall is so adherent to the surrounding gland tissue that shelling it out without tearing large blood-vessels is exceedingly difficult, and sometimes impossible.

In these cases I have found that if the tumor be cystic, tapping the cyst and evacuating some of the contents, whether fluid or semisolid, allows it to be drawn out, and then the cyst wall can be peeled off from the gland tissue with the fingers or a raspatory, much as an adherent ovarian cyst is peeled off from its surrounding structures; should a vessel come into view, it is easily tied. Thus the operation is made one which is almost entirely external to the neck.

In my first three or four cases I was astonished at the ease with which enucleation was accomplished, and with what slight hæmorrhage, and I thought the operation was a very simple one; but in my next case the cyst wall was strongly adherent to its surrounding gland tissue and intimately associated with large blood-vessels, which were torn every time a piece of cyst wall was peeled off, with the result that the loss of blood was considerable, and the time required greater than before; then it was that the idea of partially evacuating the cyst occurred to me.

My next case was one of colloid tumor with adherent capsule. I tried to shell out the cyst with my finger, but only succeeded in tearing some large blood-vessels, so I opened the capsule, rapidly turned out its contents, and then, the tension being relieved, I easily pulled out the capsule, peeling it off from the surrounding gland tissue as it was delivered, and leaving a cavity behind lined by a number of large tortuous veins which looked like the gnarled roots of an old oak. Since then, whenever I have had any difficulty in shelling out the tumor, I invariably evacuate some of its contents, then easily deliver the growth, and as it is delivered peel it off from the surrounding tissue.

Many of these growths extend down below the sternum and clavicle, being separated from the great vessels at the root of the neck by a very thin layer of gland tissue. In such cases the voice is often altered, the patient has occasional attacks of difficult breathing, and sometimes there is difficulty in swallowing.

Where the tumor is unilateral and can be pushed upward and outward beneath the sterno-mastoid muscle there is no difficulty in breathing or swallowing, and the unsightliness of the tumor is the only reason for operation.

In many cases the gland has very slowly increased in size for years without giving trouble, when suddenly it begins to increase very rapidly, this causes pain and discomfort and induces the patient to seek relief.

I may say that in many cases where the growth gave rise to no symptoms, except great nervousness, yet after removal the patient's general health improved greatly. All my cases, with one exception, were in women; they submitting much more readily to operation than men, for they have more regard for their personal appearance, besides the affection is more common in women than men.

My method of operation is as follows:

*Anæsthetic.*—In my first cases I always had chloroform administered, with the idea that in chloroform anæsthesia there was less congestion of the veins, and hence less danger of hæmorrhage; but one of my colleagues, when about to operate on a large thyroid cyst, lost a patient from chloroform-poisoning, the patient dying before the operation was commenced. Since then

I have used ether exclusively, and found that the congestion of the vessels was a bug-bear, which had only existence when the ether was given badly.

*Operation.*—The neck having been thoroughly cleansed, an incision is made some three or four inches long, directly over the tumor ; after cutting through the skin and fascia, the depressor muscles of the thyroid are reached, and if the tumor be large, they are very thin and hardly noticed. In any case they should be incised in the same line as the skin. Over the muscles and deep fascia is often seen running the anterior jugular vein, which is sometimes very large, this when met with should be divided between two ligatures. After cutting through the depressor muscles the gland is come upon ; it looks much like muscle, but bleeds freely when cut. Some glands, of course, are much more vascular than others. A small incision should be made through the gland tissue and at a greater or lesser depth, the capsule of the tumor is come down upon : this is recognized by its bluish-white color, but it requires some experience to know when the proper layer is reached. Reverdin says, truly enough, " Whenever you are doubtful, you are not on the growth." When the capsule of the tumor is reached the incision in the gland should be enlarged, and with the aid of the finger the tumor should be rapidly enucleated ; if the separation is easy or there is no hæmorrhage then the enucleation may be continued until the whole growth is freely separated. To deliver the cyst, the incision in the gland must be further enlarged.

This sometimes leads to free bleeding, which can be controlled by T-forceps or by the application of the thermo-cautery. Sometimes the gland tissue does not bleed at all, being often so thin that it appears to be part of the capsule of the tumor.

I used formerly to incise the gland more freely than I do at present, then I always endeavored to shell out the cyst or tumor. Now, if it does not come out easily, I incise it and evacuate some of its contents, in this way the tension is relaxed and the gland comes out of its bed, and, as it is delivered, the sac is peeled off easily from the surrounding gland tissue without any loss of blood.

Should there be many large vessels about the capsule these can be peeled off, or if they tear they can be tied then and there; as I said before, this proceeding makes the operation extra- instead of intracervical.

Having enucleated the cyst, others are searched for through the cavity left behind, and if found, treated in the same way; all the bleeding-points being secured, the cavity is packed with iodoform gauze, and the end of the strip of gauze allowed to protrude through the lower angle of the wound. I formerly used a drainage-tube, but the gauze acts as a good drain, and at the same time, by its pressure, arrests hæmorrhage; the skin wound is now sutured with sterilized horse-hair sutures. Where the drain protrudes, a suture of silkworm gut is introduced and left untied. Next day the wound is dressed, the gauze removed, and the opening closed with the silkworm-gut suture. The horse-hair is used, because it is cheap, elastic, easily sterilized, and is removed much more easily than silkworm gut.

In the first dressing I never wash out, or, in fact, use water or antiseptics for cleansing the wound; I merely apply sterilized or antiseptic dressings and place a bandage over them. I allow and even encourage the patients to get up on the second day, if so inclined; by doing so I believe they recover more quickly; at the end of the week I remove the stitches, and next day, in nearly all my cases, the patient is discharged. Occasionally after the operation I have seen a very rapid pulse and high temperature; but if the wound looks normal I pay no attention to these symptoms, and they seem to have no injurious effect on the course of the convalescence, being due probably to the disturbance of the gland at the time of operation.

It is extraordinary how rapidly healing takes place after these operations, even when a huge cyst has been removed. My patients have rarely remained in hospital more than a week; the vascularity of the parts and the fact that the cellular tissue planes are not interfered with might to some extent account for this.

Some of the smaller cysts seem to give more pain than the larger ones. In several cases patients have come for operation on account of the pain and discomfort caused by the tumor and not for dyspnœa and dysphagia.

In this operation, as only the diseased part is removed, there is no fear of any ill consequences following the excision.

Appended will be found the notes of sixteen cases operated on since 1883, most of them, however, have been treated in the last two years.

Dr. Bradley, under the direction of Professor Adami, has made microscopical sections of some of the removed cysts, and appended to several of the later reports are the results of their investigations.

CASE I.—*Cyst of Right Lobe of Thyroid in a Boy aged Ten Years; Wound of the Internal Jugular Vein;*[1] *Recovery.*—P. F., aged ten years, December 18, 1883, was seen in consultation with Dr. Simpson for a small tumor on right side of neck. Three years before a small growth was noticed in right side of neck which was supposed to be an enlarged gland, this grew steadily until it reached its present size, has never caused any pain or other trouble.

On examining the neck a growth the size of a large egg is seen opposite the thyroid cartilage and going under the right sterno-mastoid; it is smooth and fluctuates, moves with the thyroid during deglutition, and, although freely movable, gives the impression that it is attached deeply posteriorly.

*Operation.*—December 19, 1883. Chloroform was given and an incision three inches long made over the tumor; the tumor was easily exposed and enucleation by the finger was attempted without success; curved scissors were then used, and just as the last portion of the deeper attachment was being severed there was a sudden gush of blood; the bleeding was immediately arrested by the finger and the bleeding-point seized with artery forceps. It was found that the internal jugular vein had been opened, so it was tied in two places and cut through between the ligatures, the wound was closed with catgut sutures and drained with a rubber tube. Patient rapidly recovered, leaving hospital well on the tenth day. Pulse on second day was 116, and temperature 100.5° F.

CASE II.—*Small Solid Cyst of Right Lobe of Thyroid; Enucleation; Recovery.*—Miss C., aged thirty years. Admitted October 22, 1889. A strong, robust woman; unmarried. Has suffered for some years from a painful swelling in right side of neck. Has been growing slowly for nine years, and at times caused dyspnœa and dysphagia, voice slightly altered. Six months ago grew more rapidly and became painful. On examination a small tumor is seen, size of a large walnut, connected with the right lobe of the thyroid. It reaches down to the right sterno-clavicular articulation and is quite movable.

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[1] In this case I know now I never reached the proper cyst wall, and had I done so the jugular could not have been wounded.

*Operation.*—October 29, 1889. Ether administered. Incision over tumor, some large veins tied, gland tissue thin, but very vascular. The capsule of tumor easily detected and separated from the surrounding gland tissue with a considerable amount of hæmorrhage. The cyst contained colloid material and blood clot, and appeared to be connected with the right half of the isthmus. A drainage-tube was introduced and wound closed with silkworm-gut sutures. Drainage-tube removed next day and wound closed and redressed. Stitches removed on seventh day; exit on eighth. No temperature and very slight elevation of pulse.

CASE III.—*Large Cyst of Left Lobe of Thyroid which extended Down under the Clavicle and had been growing for some Years.*—Mrs. J. L., aged forty years. Operation by enucleation December 17, 1889. Rapid recovery. (The case-book containing the notes of this case has been lost, and the above is extracted from my private operation book.)

CASE IV.—*Two Large Colloid Cysts of Right Thyroid Lobe; Enucleation; Recovery.*—Maggie C., aged thirteen years, native of Canada. Admitted into hospital, February 20, 1893, with a hard movable tumor in the centre of the neck below the thyroid cartilage. A year ago first noticed enlargement of neck, it remained same size for some months, but latterly has grown rapidly. Always has been healthy. No pain or discomfort felt from the growth.

*Operation.*—February 23, 1893. Incision as usual over tumor. Came down rapidly on the growth, and shelled it out without much bleeding. After the first cyst was removed another was felt deeper down, this was also cut down upon through the cavity occupied by the first and removed easily by enucleation and without hæmorrhage. The first tumor was the size of a large walnut, and the second somewhat smaller. The cysts were filled with fairly solid colloid material. Both tumors turned out to be connected with the right lobe of the thyroid.

In this case subcutaneous sutures were used and no drainage. Next day temperature rose to 105° F. and gradually fell to normal on the sixth day. No suppuration. Patient discharged and the sutures still in on March 18, the fifteenth day.

Case V.—*Large Cyst in Right Lobe of Thyroid, containing Gelatinous Fluid; Enucleation; Recovery.*—Amanda M., native of Canada, aged twenty-nine years. Admitted into hospital July 5, 1893, with large cystic bronchocele.

Enlargement first noticed five years ago, and has grown steadily until four months ago, when she had a miscarriage. Since then it has grown very fast. Has never caused any pain or interfered with breathing or swallowing. Wishes operation on account of unsightliness of the neck. Is in good health, but of a nervous excitable temperament. On the right side of the neck, extending from the thyroid cartilage to beneath the sterno-mastoid and from the hyoid bone to the clavicle, is a large globular swelling, smooth, painless, and non-fluctuating. The tumor moves with the thyroid cartilage on swallowing. The left lobe of thyroid is normal. Heart's action very rapid.

*Operation.*—July 7, 1893. Chloroform was administered. An incision was made over the tumor. The anterior jugular vein came into view and was cut between two ligatures. After cutting through the depressor muscles the gland was come down upon. It was non-vascular and had the appearance of a cyst wall. Several layers were cut through before the proper cyst wall was reached, and then the tumor was rapidly enucleated by means of the operator's finger alone; before complete enucleation was accomplished, the cyst wall ruptured and a lot of gelatinous, dark-green fluid escaped. Very little hæmorrhage resulted. A huge cavity was left and through its posterior walls the carotid vessels could be seen pulsating. The cavity was irrigated with a solution of 1–5000 of sublimate solution, the skin wound closed with a subcutaneous suture, a drain being left at the lower angle,—sterilized dressing applied. Next day tube was removed, the dressings being saturated with serous oozing. On the sixth day after operation the subcutaneous suture was pulled out and the patient went home. Some weeks later she was shown at a meeting of the Montreal Medico-Chirurgical Society in splendid health and with the nervous condition much less marked.

Case VI.—*Large Cystic Bronchocele of Left Lobe of Thyroid; Recovery.*—Cordelia M., unmarried, aged twenty-three years, native of Montreal, was admitted to the General Hospital September 2, 1893, with enlargement of the neck. Tumor first appeared eight years ago, enlarging gradually. It has never been painful, nor has there ever been difficulty in swallowing or breathing, but she has great shortness of breath on exertion, which may be due to condition of anæmia, which is marked in her case.

On examining the throat a large tumor was seen on the right side, extending from the top of the thyroid cartilage to the suprasternal notch. This has all the characteristics of a cystic bronchocele, fluctuates, moves upward on swallowing, and is freely movable laterally.

*Operation.*—September 29, 1893. Chloroform administered, and an incision made directly over the tumor, some three inches long. The anterior jugular vein tied, the muscles divided and separated, and then the gland came into view. This had the appearance of the cyst wall, but on incision several layers of fibrous (?) tissue were cut through, and then the bluish-white wall of the cyst appeared. The cyst was then partially enucleated with the finger, and was found to extend deeply down beneath the clavicle. It was firmly attached on its posterior wall to the gland tissue. While enucleating the cyst it burst, discharging its thick, brownish, fluid contents. The attached portion of the cyst wall was now rapidly freed by scalpel and the cyst removed. In the bottom of the cavity that was left the carotid vessels were seen pulsating. There was very free oozing, which was partially arrested by sponge pressure and a douche of hot sublimate solution, 1–5000. The wound was closed with a subcutaneous silk suture, a drain being left at the lower angle of the wound. Usual dressings applied. Next day tube was removed and wound closed, though dressings were saturated with serous oozing.

October 3. Subcutaneous suture removed; wound quite healed.

October 7. Patient discharged from hospital eight days after the operation with wound soundly healed.

Case VII.—*Colloid Cyst of Left Thyroid Lobe; Enucleation; Recovery.*—Rachel L., unmarried, aged twenty-seven years; French Canadian. Admitted into hospital July 30, 1894, for tumor of neck. Has always been healthy. First noticed a small, hard lump in the middle line of neck below the cricoid cartilage eight years ago, which has been growing slowly ever since. Latterly it has become very painful. Has never had dyspnœa or dysphagia.

The enlargement is on the left side, and is about the size of a lemon, reaching from upper margin of the thyroid cartilage to the sternum. It is quite movable, feels soft, and does not fluctuate, and ascends with deglutition. No dyspnœa; no exophthalmos.

*Operation.*—August 2, 1894. Chloroform administered. Usual incision over the tumor made. The gland was come down upon and incised; here considerable bleeding took place. When the capsule of cyst was reached enucleation was attempted, but the bleeding was furious, so the cyst was immediately opened and its contents shelled out, and then the capsule was carefully dissected out with finger and knife, the vessels being tied as cut. The cavity, from which there was free oozing, was packed with iodoform gauze, the end of the strip of gauze being brought out at lower end of wound. The wound was then closed with horse-hair sutures and dressed as usual. The cyst contained colloid material and very little fluid. Next day the dressings were soaked with serous discharge. The gauze was removed and the wound closed.

Patient had normal temperature and pulse. Stitches removed and patient discharged well, August 11, the ninth day after operation.

CASE VIII.—*Large Colloid Bronchocele of Left Side, very Adherent; Recovery.*—Bella E., aged twenty-nine years, English Canadian. Admitted into the Montreal General Hospital, September 20, 1894, with enlarged thyroid.

Seven years ago first noticed the neck commencing to enlarge on the left side. The tumor has always been soft and movable. Grew slowly until a year ago, when it rapidly increased. Has had all kinds of local applications. Tumor causes a great deal of discomfort and aches at times severely. Patient is of a highly nervous temperament, and loses a great deal of blood at every menstrual period. There is a large tumor of the thyroid on the left side, reaching from the middle line well under the sterno-mastoid muscle and from the upper border of the thyroid cartilage to the clavicle and beneath it. The tumor is soft and does not fluctuate, ascends with the cartilage during deglutition, and is freely movable. Right half of the gland is normal.

*Operation.*—September 21, 1894. Ether given. Incision some three inches long over the growth and the gland exposed. Over the gland coursed some very large veins which were ligatured. When the capsule of the tumor was reached, it was found that attempted enucleation caused great bleeding, and that the finger did not easily get around the growth, so the tumor was cut into, and its contents, which consisted of solid colloid material, were shelled out. Then the capsule was carefully pulled out of the wound, and as it came out the adhesions were separated, and if a vessel was torn, as often happened, it was immediately tied. In this way the whole capsule was removed, leaving behind a cavity lined with huge blood-vessels. This cavity extended below the clavicle and behind the sternum. As there was considerable oozing from the cavity, it was packed with iodoform gauze. The wound was closed with horse-hair sutures and was dressed with sterilized gauze and cotton and a bandage applied. The gauze was brought out at the lower end of the wound, a silkworm-gut suture being left untied.

Next day gauze was removed and wound closed. Stitches removed on the 26th, and patient discharged well with wound soundly healed on the 28th, the seventh day after operation.

I have occasionally seen the patient since, and she is in much better general health and suffers much less from nervousness.

CASE IX.—*Multiple Colloid Cysts of both Lobes of Thyroid Gland; Removal by Enucleation; Recovery.*—Mrs. H., widow, aged thirty-five years; English Canadian; telegraph operator. Admitted into hospital, December 16, 1894, for enlarged thyroid. Is a delicate-looking woman, highly nervous, and with some exophthalmos. She has had an enlargement of the neck since childhood. Seven years ago the enlargement suddenly increased, but disappeared again on the application of an ointment. This increase was accompanied by palpitation of the heart and great nervous excitability. From that time the gland has slowly enlarged until last summer, when the growth was much more rapid. Latterly has difficulty of breathing on exertion. The neck is larger during menstruation and when she laces tightly.

On examination of the neck it is found that the left lobe is the larger, but both lobes extend from the hyoid bone to the clavicle. The enlargement seems to be due to a number of solid growths in the thyroid gland. Several very hard nodules are felt in the left lobe. Patient latterly has been unable to do her work, chiefly on account of nervousness.

*Operation.*—December 17, 1894. Ether administered. On cutting down on the left side over the growth one or two large veins had to be ligated, and on cutting through a thin layer of gland the capsule of the largest cyst was reached, and this was easily shelled out. Several other cysts were now felt, and through the posterior wall of the cavity left by the large one several smaller cysts were rapidly enucleated with considerable hæmorrhage, which was controlled by tampons. A number of very small cysts the size of beans were now shelled out, and the cavities packed with iodoform gauze. An incision was then made over the right half of the gland, and here a number of small solid tumors were found, and some with very adherent capsules had to be dissected out. One or two were evidently very old, being quite cartilaginous. There was considerable bleeding, which was controlled by pressure and ligature. Iodoform gauze was freely used to pack the cavities, and the wounds were closed with horse-hair sutures. Next day gauze was removed, and on the eighth day stitches were taken out and patient discharged well.[1]

In this case, on the evening of the operation, the pulse rose to 140, and continued as high as 120 for four days, the temperature rising to 101.5° F. the second day, but there was no suppuration, and union was complete in a week.

*Pathological report* by Dr. Bradley, of the McGill Pathological Laboratory. Sections show vesicles filled with colloid, in general of large size. Between the large-sized ones are occasional very small vesicles, which also contained colloid material. No appearance of colloid in the lymphatics.

In several places there is evidence of the coming together of vesicles by atrophy of intermediate wall, and small processes are seen standing out as in emphysematous lungs.

The epithelium of the vesicles is greatly flattened, consisting of little else than small rounded nuclei. The colloid is homogeneous, each vesicle contains a few large round cells with much protoplasm.

CASE X.—*Diffuse Enlargement of both Lobes of the Thyroid; Excision of Left Lobe and Isthmus.*—Marie F., aged twenty years, French Canadian, was admitted into hospital, January 15, 1895, for enlarged thyroid.

*History.*—The enlargement of thyroid commenced five or six years ago, on the right side and shortly afterwards on the left. The growth increased very slowly at first, but during the past year its increase has been rapid, and more so during the past month. At times has paroxysmal attacks of dyspnœa, but no nervousness or palpitation of the heart. Menstruation has been profuse and painful and has occurred every three weeks. No exophthalmos.

*Present Condition.*—Appears to be a healthy, well-nourished girl. Neck much enlarged, more on right side ; this enlargement connected with the thyroid ; no distinct tumor can be made out ; the whole gland apparently affected with diffuse hypertrophy. The enlargement reaches upper border of thyroid cartilage to sterno-clavicular articulation of both sides, and the whole growth about the size of a medium-sized orange.

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[1] I have seen her several times since, and she tells me her health has much improved, and that she is now able to attend to her business without fatigue.

*Operation.*—January 18, 1895. Ether administered. An incision made three inches long to inner side of right sterno-mastoid muscle and over the tumor, and after tying some large veins the gland was reached and incised; as expected, there was no encapsuled tumor, but the whole gland was evenly enlarged. It was not very vascular. The isthmus was very much hypertrophied and it pressed on the trachea. After first tying the superior thyroid arteries and veins and then the inferior thyroid branches as they entered the gland, the right half of the thyroid was dissected out, care being taken to avoid injuring the recurrent laryngeal nerve on that side. The isthmus was then freed with a knife from the trachea, to which it was firmly adherent, and was tied off with a strong catgut ligature. The right half of the gland and isthmus were removed without hæmorrhage. The wound was closed with horse-hair suture and drained with a small rubber tube. Next day tube was removed and wound redressed. The temperature went up to 103° F., and pulse to 120, and this was the first case in which I had any suppuration. By the end of the week the temperature had fallen to normal, and the patient was sent out on the sixteenth day with wound firmly healed. The next week she returned with a small sinus which had opened, and through which protruded a small ligature. This was removed and the sinus closed.

*Pathological report* by Dr. Bradley. Sections show densely-packed vesicles in general below normal size, with, however, occasional larger vesicles.

Epithelium cubical, almost coalescent in some cases; these here and there show a clear, free, internal margin. Colloid material much shrunken, so that large, clear vacuoles appear between the narrower central mass and the epithelium. Occasional hæmorrhages, both interstitial and intervesicular. Between some of the lobules great development of hyaline fibrous tissue, with atrophy of peripheral vesicles.

CASE XI.—*Colloid Cysts of Right Lobe of Thyroid; Profuse Hæmorrhage; Ligature of the Thyroid Arteries and subsequent Sloughing of the Right Half of Gland; Recovery.*—Mrs. S., aged fifty-six years, native of and has always lived in Ontario, entered a private ward in the Montreal General Hospital, January 22, 1895, for an enlargement of right lobe of thyroid. (Patient is a spare, wiry woman, of an excessively nervous temperament, skin somewhat jaundiced.)

First noticed an enlargement of the thyroid ten years ago; while crossing the Atlantic was violently sea-sick, and shortly after she noticed a small lump in right side of neck. This has been growing steadily ever since. The growth has been more rapid in the last three months. At first the tumor was very movable, but recently has become more fixed. It still moves with deglutition. Last year, for the first time, patient had some difficulty in swallowing, and this has continued ever since when solid food is taken. Respiration has never been interfered with, but the tumor has often been painful. The tumor is about the size of a small orange; patient has an enlarged liver which has existed for some years, and soon after its commencement was said to be due to malignant disease; had ascites at one time. Her health has never been robust.

*Operation.*—January 24, 1895. Ether administered. Usual incision over the tumor and sac soon reached. Over its surface coursed a number of large veins, which were tied. The sac itself was so friable that it was found impossible to shell it out, and the solid contents were evacuated and found to consist of a reddish-brown material. The capsule was now removed piecemeal from the gland tissue to which it was firmly adherent. The sac was so friable and the parts about so vascular that considerable difficulty was experienced in arresting the hæmorrhage. At the bottom of the cavity left by the cyst another smaller one was discovered, and, as there was still considerable bleeding, it was thought proper before removing the second tumor to ligate the inferior thyroid artery, and the second cyst was removed without any hæmorrhage, the wound was closed with horse-hair sutures after packing the cavity from which the large cyst was taken with iodoform gauze.

Next day the iodoform gauze was removed and the wound closed. On January 26, temperature had risen to 103° F., and the wound was discharging a thin sero-pus. Pulse rapid. During the next week the evening temperature averaged 102° F., and the dressings were removed and lead lotion was applied. There was considerable swelling and pain. Wound opened, and through the opening one could see a quantity of sloughing gland tissue, which was removed in large pieces daily. This went on until the whole right half of the thyroid came away. Patient also had all this time a troublesome cough. As soon as all the slough came away patient's temperature became normal, and she rapidly improved, and left the hospital with a small sinus on February 14, 1885, the eighteenth day after operation.

*Pathological Report.*—The majority of the vesicles have no lumen, being simply clumps of cells with nuclei tending to be peripheral. Some contain dense colloid material with brown stain. In a few this material shows a definite concentric arrangement. Epithelium around these is of a very irregular depth, many contain clear, transparent crystals (seen both after staining with carmine and hæmotoxylin). These crystals are relatively large, and vary in shape from almost a perfect square to rhomboid with occasional truncated cubes.

Some periarteritis. Small hæmorrhages into the substance with areas in which the capillaries are greatly dilated and the vesicles relatively far apart.

The whole appearance is that of undeveloped vesicles. Probably atrophy, though, for that, there is peculiarly little relative increase of fibrous stroma. The case looks like one of adenoma.

CASE XII.—*Two Cysts in Right Lobe of Thyroid; Enucleation; Recovery.*—Mrs. G., aged twenty-five years, native of the Province of Quebec, was admitted into the hospital, April 11, 1895, for a swelling of neck.

First noticed enlargement on right side of the neck six years ago; growth was small, but slowly increased until a year ago, when it grew rapidly and seemed to change its position, growing more towards the sternum. At first there was no pain or inconvenience, but during last year or two has had difficulty in breathing, and also dryness of throat, and difficulty in swallowing. She has also been in a highly nervous and excitable condition for some time past, and has lost flesh lately. Has a brother with a similar enlargement of the neck.

On examination the right lobe of the thyroid is found to be much enlarged, owing to a tumor which can be distinctly made out; this growth is very movable and reaches from the sternum to the middle of the thyroid cartilage. It is non-fluctuating, and appears to be about the size of a Tangarine orange.

*Operation.*—April 15, 1895. Incision over tumor. Anterior jugular vein tied, the gland incised, and cyst reached. It was found impossible to easily enucleate the cyst, so some of its contents, which consisted of a thick greenish-brown fluid, were evacuated, and then the opening closed with forceps. The cyst was easily lifted out with the lower part of the thyroid and peeled off gradually from the surrounding gland tissue and blood-vessels; through the cavity left another cyst about half the size of the first could be felt, which was cut down upon, its contents (brownish fluid) evacuated, and the capsule removed, as in the previous one. The hæmorrhage from this latter enucleation was somewhat free, but was stopped by packing with iodoform gauze.

Next day gauze was removed. The stitches were taken out on the sixth day, and she was discharged with a soundly-healed wound on the seventh day. This patient never had a temperature or pulse over 100.

*Pathological Report.*—(Dr. Bradley.) Fluid of cyst contains a large number of cholesterine crystals, hæmotoxylin crystals, and large round cells containing fatty globules; fluid is of a glairy consistency and of a yellowish-brown color. Cyst wall is made up of several layers of fibrous tissue with occasional short imperfect layers, containing numerous small nuclei. On the inner surface are numerous fairly well developed vesicles with distinct epithelium somewhat flattened, and some are multiple, as if due to the coming together of several. In addition small fibroid areas with atrophy of gland tissue and scattered deposits of calcareous material are seen.

Case XIII.—*Colloid Cyst of Right Lobe of Thyroid; Enucleation; Recovery.*—Emily L., aged twenty-three years, native of Quebec, was admitted into hospital, April 15, 1895, for enlarged thyroid.

Three years ago patient first noticed a lump in the neck the size of a filbert; it was situated to the right of the median line below the thyroid cartilage; grew very slowly until last year, when it suddenly increased in size. Has never caused any pain or inconvenience, and she wishes it removed because it is unsightly. She has always enjoyed perfect health. Two female cousins have similar enlargements of the neck.

On examining neck the tumor is found to be confined to the right lobe of the thyroid, is freely movable, is chiefly situated beneath the sterno-mastoid muscle, and is most easily pushed upward and outward. It is about the size of a lemon and feels somewhat solid.

*Operation.*—April 26, 1895. Ether administered. Usual incision over the tumor, tied the anterior jugular vein, and after cutting through the depressors of the hyoid the gland was reached. It was found to be somewhat more vascular than usual. The cyst was situated deep in its substance, and nearly a quarter of an inch of gland had to be incised before the capsule of the tumor was come down upon. As it would not readily "shell out," the capsule was opened and some of its solid contents evacuated, and as the cyst was delivered it was peeled off from the surrounding tissue as in the other cases. The sac was very thin and very adherent. There was considerable bleeding after the cyst was extirpated, so the cavity was packed with iodoform gauze. The cut edges of the incision in the gland bled freely, and the thermo-cautery had to be used to stop the bleeding. Skin wound closed with horse-hair sutures. Next day pulse went up to 104, and temperature to 102° F. The gauze was removed and the loose ligature tied. There was no more rise of temperature, and the wound was firmly united on the sixth day, when the stitches were removed, and next day she went to her home in the country.

*Pathological Report.*—(Dr. Bradley.) Cyst wall formed of several layers of fibrous tissue with intermediate partial layers of atrophied gland tissue, vesicles of colloid material, average one-half of Winkel's ocular micrometer.

CASE XIV.—*Cyst of Left Lobe of Thyroid; Enucleation; Recovery.*—Lizzie C., aged twenty-one years, native of Montreal, was admitted into hospital, May 4, 1895, for enlargement of left lobe of thyroid.

First noticed swelling of neck in May, 1894; grew slowly until three months ago, when it rapidly increased. Has always been freely movable, especially on swallowing. Tumor never gave rise to any pain or dyspnœa, and she wishes operation solely on account of the unsightliness of the growth. Patient, although she never has been ill, is very anæmic, and is troubled a good deal with shortness of breath and palpitation. On examining the neck, a swelling is seen on the left side opposite the lower border of the thyroid cartilage, is partially under the sterno-mastoid muscle. It reaches to near the sternum and is about the size of a hen's egg. The tumor is well defined, movable, and feels like a solid growth.

*Operation.*—May 6, 1895. Ether administered. Usual incision over the tumor, the anterior jugular vein tied, the gland incised to the depth of one-eighth of an inch, and the bluish-white capsule of the cyst reached. It did not "shell out" easily, so an incision was made into it and some dark yellowish-brown fluid evacuated with clots of blood. The opening was closed with forceps and the tumor came out easily; as it came out its attachments to the surrounding gland tissue were freed and the adherent vessels tied. The cyst wall appeared to be composed of several layers of tissue arranged in a tessellated manner. After delivery of the cyst the bleeding was quite free, but after securing some of the vessels and packing the cavity with iodoform gauze the bleeding was controlled. The wound was closed with horse-hair sutures. Next day gauze was removed and opening closed. On the fifth day the stitches were removed, and on the sixth day patient went home with the wound soundly healed. She had no elevation of temperature except 100° F. on first day after operation. Pulse never went over 100.

*Pathological Report.*—Shows cyst wall formed of fibrous tissue and compressed *vesicles.* Shows also fibrous tissue growing between the vesicles that are in the *gland itself* and adjoining the *wall.* Vesicles measure from three to forty divisions of Winckel's micrometer.

CASE XV.—*Cyst of Left Lobe of Thyroid; Enucleation; Recovery.*—Mrs. J., aged thirty years, native of Dublin, Ireland, has been in Canada fifteen years. A large, stout, healthy-looking woman, was admitted into the hospital, May 12, 1895, for enlargement of left lobe of thyroid. Enlargement commenced twelve years ago, and has been growing slowly ever since. Has caused her a great deal of pain, is especially painful when she lies on the right side. Dyspnœa has been present for years, and has been worse, especially on exertion, during the last four months. Swallowing somewhat difficult, and patient has to eat very slowly. The tumor appears to be about the size of a small orange, reaching from the upper border of the thyroid cartilage to within an inch of the sternum. Moves with deglutition. When in its usual position is chiefly beneath the sterno-mastoid. Feels hard and nodular.

*Operation.*—May 13, 1895. Ether administered. Incision over tumor and to inner side of sterno-mastoid muscle. Two large veins tied, and when gland was reached several veins of large size were seen running over it; these were ligated. The gland was incised and cyst wall reached. This was found to be very dense and adherent, so the cyst was tapped and some straw-colored fluid evacuated, and the cyst lifted out and separated from the surrounding adherent gland tissue with raspatory and knife.

Several very dense nodules seemed to be outgrowths of the larger cyst. Not much bleeding. Cavity packed with iodoform gauze and wound closed with horse-hair sutures. Next day gauze removed and wound closed. On the sixth day, May 20, the sutures were removed and patient left hospital well. No pain and feeling much better.

CASE XVI.—*Large Cystic Tumor of the Left Lobe of Thyroid; Enucleation; Recovery.*—(This case occurred after the reading of this paper.) Mary McL., native of Province of Quebec, aged nineteen years, entered the Montreal General Hospital, June 4, 1895, for tumor of thyroid.

Patient has always been healthy, but of late has been very anæmic. Six years ago she first noticed an enlargement in the middle line of neck, smooth and elastic.

During the first six months it did not grow, then for the next two years it grew slowly, latterly it has increased much more rapidly. Never has caused any pain, but she is very breathless when walking, and cannot talk and walk at the same time, breathless also on reading aloud.

Patient is a well-nourished young woman of a fair complexion and showing signs of anæmia. No exophthalmos; temperature 99.2° F.; pulse 80; respiration 24.

Over the region of the thyroid is a large, smooth, elastic swelling, larger on the left than the right side. This swelling reaches from one sterno-mastoid muscle to the other, and from the hyoid bone to the sternum it fluctuates and appears to be made up of two cysts, one small one on the right side, and the larger on the left side of the neck.

*Operation.*—June 7, 1895. Ether was administered and an incision was made over the most prominent part of the tumor on the left side. Some large veins tied and the gland reached and incised. The bluish-gray wall of the cyst was easily recognized, and, as the cyst was a very large one, it was incised and some of its contents evacuated.

These consisted of dark-brown fluid, somewhat thickish in consistency; about twelve ounces were evacuated and then the cyst was pulled out with the surrounding gland and gradually peeled off from the adherent tissue. The capsule was somewhat vascular and was attached on its posterior wall, from which were growing several small adenoid tumors the size of walnuts. After some trouble the cyst was completely enucleated and a number of bleeding points were secured in the huge cavity that was left behind. It was found that the whole swelling was one large cyst, and that the appearance of a second cyst on the right side was due to a constricting band. The cavity was packed with iodoform gauze and the wound closed, except at its lower end, with horse-hair sutures.

Next day the gauze was removed and a considerable quantity of bloody serum evacuated. The lower end of wound from which the gauze protruded was closed with a suture. As there was some temperature and swelling, on the third day the dressings were removed and some bloody serum evacuated with a grooved director. On the sixth day the sutures were removed, and wound was found to be firmly healed. In this case the temperature rose to 103° F., the day after operation, but gradually fell to normal on the sixth day. Patient sat up on the second day and felt well and slept well. The temperature possibly was due to the tension caused by the serum as well as to the disturbance of the gland, but there was no evidence of sepsis throughout the case.

*Pathological Report.*—(Dr. Johnston.) Sections through the cyst wall and solid portion of the cyst show epithelium arranged in the small, round alveoli characteristic of thyroid tissue. The cells on the walls of the cyst are flattened, swollen, and show colloid changes.

# THE "SUBGLUTEAL" TRIANGLE AND ITS SURGICAL IMPORTANCE.[1]

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THE principal tissues in the gluteal region are the muscles and their fascias; the nerves of the sacral plexus, the greater and lesser sciatic, the gluteal, and pudic; some of the branches of the internal iliac artery, the gluteal, sciatic, and pudic.

If we survey this region,—that is, the nates,—and the posterior thigh, with the skin and superficial fascia removed, we will see the glutæus maximus muscle, and below this the hamstring muscles, the flexors of the leg on the thigh.

If, now, we observe this region carefully, we will see that one band of the hamstring muscles passes obliquely downward and across from the inner to the outer side of the thigh from beneath the glutæus maximus muscle. This is the long head of the biceps, which crosses over to meet the short head, and thus form the outer hamstring. These muscles are here held together by an intermuscular septum, which passes down and forms a band between the biceps and the vastus externus. The fascia lata on the back of the thigh extends downward from the crest of the ilium, sacrum, and coccyx, and, splitting, includes the glutæus maximus between its two layers. It then covers the hamstring muscles and sends in two septa, one to separate the vastus externus from the outer hamstring, the other to separate the vastus internus from the adductors. (Fig. 1.)

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[1] Read before the Surgical Section of the New York Academy of Medicine, January 11, 1895.

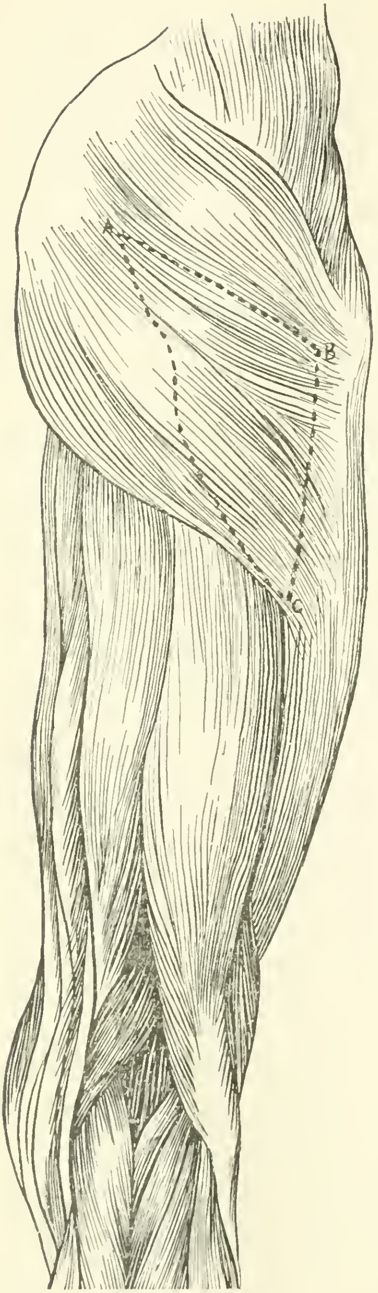

Fig. 1.—Posterior muscles of the thigh.

The door of the triangle in question is opened by cutting through the glutæus maximus muscle and reflecting it on either side. (Fig. 2.)

We now notice that the point where the glutæus maximus comes in contact with the biceps is the apex of a triangle, the outer border of which is the line of attachment of the gluteus maximus continued upward towards the great trochanter, the inner is the long head of the biceps extending up to the tuber ischii. An imaginary line drawn between these two points—namely, the greater trochanter and the tuber ischii—might complete this triangle; but if we look a little higher, we will see the pyriformis muscle running across from the greater trochanter to disappear beneath the sacro-sciatic ligament a little above the tuber ischii and forming the base. Its borders would therefore be externally the line of attachment of the glutæus maximus to the femur and its greater trochanter; internally, the long head of the biceps, the tuber ischii, and part of the sacro-sciatic ligament; and above the pyriformis. If we want to be more exact in regard to the apex, we can go a little further and say that it is formed by the uniting of the two heads of the biceps, in which case the attachment of the lesser head would form part of the outer border of the triangle. The floor is made by the superior and inferior gemelli, the obturators, internus and externus, the quadratus femoris, and the adductor magnus.

The contents of this triangle are arteries, veins, nerves, lymphatics, fatty tissue, and bursæ. The arteries are the sciatic and pudic, terminal branches of the internal iliac, the internal circumflex, and the superior perforating.

The sciatic artery is about the size of the lingual. It is seen in the upper part of this space, appearing at the lower border of the pyriformis muscle, between the lesser sciatic and pudic nerves, and descends downward just to the outer side of the tuber ischii. Over the floor of this space it anastomoses with the internal circumflex and the superior perforating. Its branches in this region are the coccygeal, inferior gluteal, comes nervi ischiadici, muscular and articular. The

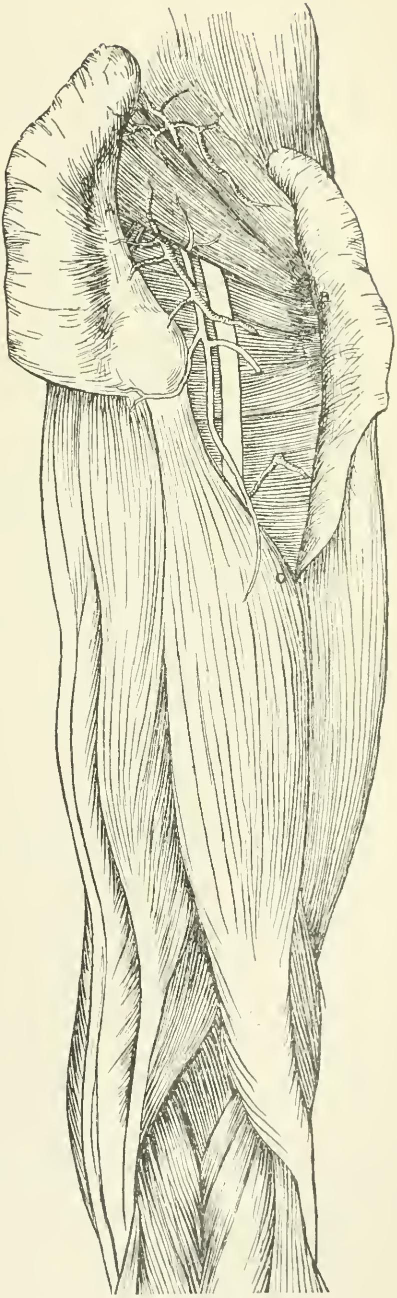

FIG. 2 —The subgluteal triangle.

internal pudic artery runs over the spine of the ischium at the upper inner angle of the space, escaping from the pelvis through the great sacro-sciatic notch, and re-entering it through the lesser sacro-sciatic foramen. This is also a terminal branch of the internal iliac artery.

The internal circumflex is a branch of the profunda femoris, and comes from the anterior region of the thigh, entering this space between the quadratus femoris and the upper border of the adductor magnus, and giving off ascending and descending branches.

The superior perforating pierces the adductor magnus near the apex of this triangle, and also gives off ascending and descending branches.

These arteries form a chain of anastomoses along the posterior surface of the thigh on the adductor magnus, anastomosing with one another and indirectly with the profunda and branches of the popliteal below. This chain of anastomoses chiefly supplies the collateral circulation after ligature of the femoral artery above the profunda. The femoral artery occasionally runs through this region to the popliteal space in company with the great sciatic nerve. The artery in this case is not really the femoral, but a greatly enlarged sciatic.

*Veins.*—The veins of this region are the sciatic and the venæ comites accompanying the pudic.

*Nerves.*—The nerves found here are from the sacral plexus, the great and small sciatic, the nerve to the obturator internus, and the pudic. The pudic nerve runs the same course as the artery across the upper and inner angle.

The small sciatic runs down through the space superficially.

The great sciatic extends through the centre of the triangle, a little nearer the inner border, and disappears beneath the long head of the biceps. It is the largest nerve in the body. Occasionally this nerve pierces the pyriformis muscle instead of passing beneath it, and at other times it divides into the internal and external popliteal in this space.

The nerve to the obturator internus is also seen in the upper and inner angle of this space.

*Lymphatics.*—These follow the course of the sciatic artery, and then the internal iliac up to the lumbar region.

*Bursæ.*—These will be considered later.

*Surgical Importance of this Space.*—Perhaps the most important step that can be taken here is the stretching of the sciatic nerve. This has been done for sciatica, locomotor ataxia, and the like, but is usually performed at present for leprosy.

In these cases it is not a curative but a palliative operation, and its results are more satisfactory to the patient than those obtained by any medicine. For a long time it was thought that operating on lepers was not advisable on account of their cachectic condition.

Some operators claim, however, that the wounds of lepers heal more quickly than those of healthy individuals, and argue that this is due to the rapid clotting of blood on account of the extra amount of fibrin it contains. Rake, of St. Louis, who was for some time in charge of a leper asylum in Trinidad, estimates the amount of fibrin in the blood of a leper as three times that found in normal blood.

The stretching of the nerve in lepers is usually performed for anæsthesia, pain, ulceration, necrosis, and tuberculation. It is most commonly stretched in the anæsthetic variety for perforating ulcer of the foot, with or without pain. The relief in these cases is often marvellous, and patients who begged for an amputation on account of the pain present have been almost immediately relieved by stretching. The relief derived from such a procedure frequently lasts for a year, the pain disappearing and the perforating ulcer healing. In 50 per cent. of these cases the nerve has been found to be enlarged.

The operation usually consists in making a vertical incision, midway between the tuber ischii and the greater trochanter through the glutæus maximus. In this way, one does not come directly on the nerve, as it lies a little nearer the tuber ischii.

A better incision is one made just below the lower border of the glutæus maximus muscle through the skin, superficial and deep fascias. This enables us to reach the nerve and stretch it without cutting any muscular fibres. If an incision of this nature is made, the fingers can be introduced into the triangle. If they are introduced palm downward, the outer border of the insertion of the glutæus maximus can be easily felt, and then by sweeping the fingers inward, the nerve can be easily encountered. Having taken hold of the nerve, it is better to place four fingers of the hand beneath it, rather than one, as it is then more evenly supported. In stretching, care must be taken to stretch steadily and slowly, and not with sufficient force to tear the nerve. Trombetta, who has gone into the subject quite extensively, found that it takes 183 pounds of force to tear the sciatic. Thus the ordinary patient could be lifted clear from the operating-table without tearing the nerve. It appears, however, that it would be exceedingly dangerous to stretch the nerve to this extent, for, whereas the force might not be sufficient to tear the nerve proper, it might tear it from its origin in the spinal cord.

*Aneurism of the Sciatic Artery.*—The usual aneurism of this part forms a tumor circumscribed or diffused on the side of the buttock some distance behind the great trochanter. It usually has some sound, a whir or a hum, which in the same case may be at times present and at times absent. It is usually accompanied by a considerable pain, not confined to its seat, but running forward on the dorsum ilii, downward on the back of the thigh and leg, and sometimes in the perineum ; in fact, taking the direction of the courses of the nerves on which it presses. Severe cramps of the leg and foot frequently accompany this trouble. Thus, it has often been mistaken for rheumatism, gout, sciatica, and other diseases, and treated as such.

Aneurisms in this locality are frequently the result of injury, falls, blows, etc. They are diffuse or sacculated. They vary in size from a hen's egg to a child's head.

There are several methods of treating aneurism of this artery. Of these, the ligation of the internal iliac seems to be the most popular, but the results have not been as good as in the cases of injecting coagulating fluid and the opening and tying at both ends (Antyllus's method).

*Hæmorrhage of this artery* frequently occurs, due to punctured wounds in the gluteal region, and is very troublesome and unsatisfactory to handle. The artery in these cases may be wounded in this region, or the instrument may penetrate through one of the notches and wound it or the internal iliac in the pelvis. In such instances, the diagnosis of the source of the hæmorrhage is difficult, and the ground should be explored by enlarging the wound and inserting a finger, or by making a subgluteal incision and going up into the space from below. If the vessel is wounded in the triangle, it should be ligated on either side of the wound.

If it be intrapelvic, compression of the common iliac should be first tried. Pressure must at the same time be made on the wound itself to assist in the formation of a clot at this point. If this does not succeed, ligation of the internal iliac must be resorted to.

Enormous hæmorrhages have been recorded as occurring under the glutæus maximus, of sufficient size to cause the death of the patient.

The pudic artery may also be wounded in this space.

*Ligation of the Sciatic Artery.*—This artery escapes from the pelvis through the great sacro-sciatic opening. It is accompanied by a vein which lies at its inner side.

Make an incision two inches long in the centre of a line drawn from the posterior superior spinous process to the tuber ischii, and ligate it where it emerges from the pelvis. It is on the inner side of the lesser sciatic nerve. A little internal to this is the pudic artery, accompanied by its venæ comites.

*Bursæ.*—There are three principal synovial bursæ in this region separating the under surface of the glutæus maximus from the eminences which it covers.

One of these of large size, and generally multilocular, separates it from the greater trochanter.

A second, often wanting, is situated on the tuberosity of the ischium.

A third is found between the tendon of the muscle and the vastus externus.

*Inflammation of these Bursæ.*—In the first class there is usually a history of a blow upon the trochanter, which is rapidly followed by a swelling and pain over the injured part. Suppuration may then set in, often forming large accumulations which burst, giving relief. The part now feels free and painless, and the patient recovers rapidly, or else a sinus follows. This resembles hip-disease somewhat; the principal points of difference between the two are that in the former there is no pain on forcing the joint surfaces together, nor by upward force imparted to the femoral head by blows upon the knee, etc. There is also no pain in the hip-joint itself or any referred to the knee, but there is pain on pressure right over the trochanter. This condition often gives rise to caries of the trochanter.

*Treatment.*—If the collection is large, aspirate or incise. When there is a sinus, it should be treated accordingly.

The inflammation of the bursæ which frequently exists over the tuber ischii is very annoying. It usually occurs in those whose occupations demand a sitting position, with an occasional gliding movement. These lesions are called "weaver's or lighterman's bottoms." If suppuration occurs, troublesome sinuses are apt to result.

*Ischiatic Herniæ.*—These are very rare. The subject has been quite extensively investigated by Le Dentu and Wassilieff; and Bertrandi, Lasus, Verdier, Jones, Camper, and others have reported cases. It is probable, however, that there are many herniæ of this variety that have never come to the surgeon's notice, or that coming have not been diagnosticated. This is proven by the fact that cases have occasionally been found at autopsies which have given no trouble to the individual during life.

These cases are extremely difficult to diagnose, as they are concealed from view and are rendered difficult to palpate through that thick pad of muscle,—the glutæus maximus.

These herniæ are usually small, but they are sometimes of large size. They may contain omentum, large or small intestines, mesentery, and even rectum or bladder, singly or combined.

They usually follow the course of the internal iliac artery. There are two varieties, those above and below the pyriformis. The second variety would come into the space in question. They descend between the inferior border of the pyriformis and the lesser sacro-sciatic ligament. They can be reduced by taxis in some cases, while in others an operation is necessary. In case of strangulation, incision should be made inward into the sacro-sciatic ligament.

*Gluteal Abscesses.*—Abscesses may occur in this space *de novo*, or there may be collections of pus coming out through the great sciatic notch from caries of the vertebræ or pelvic bones; or abscesses of the tissues within the pelvis.

This is not the favorite path for the abscess of Pott's disease to travel; as, for example, in the table of Michel, but three opened in the gluteal region, whereas fourteen occupied the iliac fossæ and the upper and inner or outer part of the corresponding thigh. The pus from these abscesses occasionally does not stop in this region, but keeps on down the thigh to the popliteal space, and even to the region of the ankle.

*Excision of the Hip-Joint.*—The close association between the floor of this space and the hip-joint is important to be borne in mind in excisions of that joint on account of the danger of wounding the important tissues contained here. This may be avoided by attention to the valuable points advocated by Langenbeck and Sayre,—that is, to perform as much of a subperiosteal operation as possible, and if the tendons of the muscles attached to the great trochanter behind are to be cut, the effort should be made to dissect them away from their insertions on the bone.

# NEURAL INFIXATION.[1]

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BY the term neural infixation I mean the implanting or engrafting of one nerve into the other.

Whilst based on the same physiological principles as those which govern the suturing of nerves, I am inclined to the belief that there are other factors which enter into neural infixation that do not necessarily accompany nerve suturing.

I am greatly indebted to Professor G. Carl Huber, of the University of Michigan, for two very interesting reprints,[2] in which was published a " Physiological, Histological, and Clinical Study of the Degeneration and Regeneration in Peripheral Nerve Fibres after Severance of their Connections with the Nerve Centres." The conclusions arrived at in these monographs embrace the combined experiments of Professors Howell and Huber. In addition to these reprints, Professor Huber has very kindly given me additional data relative to nerve suturing up to the present date, and has very generously allowed me to use, in this paper, extracts of the text of a paper which he is now preparing on this subject.

In these experiments, conducted by Professors Howell and Huber, it was demonstrated that whenever a nerve is cut, the peripheral part undergoes degeneration. In this degeneration the axis cylinder is involved together with the medullary sheath. They were led to believe that such a thing as primary union without degeneration of the axis cylinder and medullary sheath did not and would not occur in either experimental work or surgical practice. They also arrived at the conclusion that the degenerated portion of the peripheral nerve was regenerated by the downward-growing axis cylinder of the central stump. In a communication received from Professor Huber, under date of March 26, he says, "As far as we could make out, there was no regeneration of the peripheral stump unless it was sutured to the central stump, or unless means were provided for the down-growing central axis cylinder to reach the peripheral stump."

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[1] A paper read before the Ohio State Medical Society at its Fiftieth Anniversary, held at Columbus, Ohio, May 15, 16, and 17, 1895.

[2] Journal of Physiology, Vol. XIII, No. 5, and Vol. XIV, No. 1.

So-called nerve-grafting was performed as early as 1872 by Letievant, of France, to which I shall refer later on in this paper.

The reprint above referred to credits Flourins with having cut the two principal trunks of the brachial plexus in the fowl, putting one to the upper and one to the lower surface of the wing. The ends were then cross-sutured. After some months the bird regained the use of its wings, and mechanical stimulation of the central end of the nerve-trunk caused movements of the muscles of the lower surface of the wing, and *vice versa.*

A study of the experimental work of these eminent physiological experimenters and observers is quite sufficient to demonstrate that nerve suturing is not only possible, but practicable.

Without taking up further time in the study of the physiological and histological changes that take place in nerves after section or excision, I will proceed to consider, briefly, from a clinical stand-point, a slightly different form of the same class of cases.

In the research made on this subject I have been unable to find any one who has, either experimentally or otherwise, performed the operation of neural infixation after the method introduced by Dr. W. J. Galbraith, of Omaha, Neb. The doctor's method is intended to prevent paralysis when a section of the nerve has been destroyed, by accident or otherwise, where the gap between the central and peripheral ends is so great that it cannot be sutured, or bridged across with catgut, or tunnelled over with a tube of decalcified bone. Under these circumstances the doctor has demonstrated by his case that the central end of a nerve can be implanted into a parallel nerve at a certain point, and two or three inches lower down the peripheral end can be infixed into the same nerve, and that the impressions of the injured nerve will be carried through the section of the parallel nerve, from the central end to the peripheral end of the injured nerve, and *vice versa*.

The question will no doubt arise as to why the peripheral end of the injured nerve does not undergo degeneration, which has been so lucidly described by Howell and Huber, in both direct and indirect nerve suturing, or if it does undergo degeneration, how shall we account for its regeneration and the return of its normal functions?

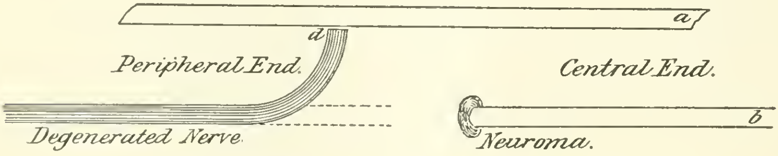

FIG. 1.—Nerve-grafting, according to Letievant.

By referring to the case of the French surgeon, Letievant, we find that the central end (Fig. 1) was not implanted into the healthy parallel nerve, but only the peripheral end was infixed, and the result was a bulb or neuroma formed at the central end, and degeneration of the peripheral end was a natural consequence. It only requires a glance to observe that there was no connection between the central and peripheral ends of this nerve, consequently it is not surprising that these unfavorable results followed.

Professor Huber, in conducting the experiments on cross-suturing (Fig. 2), cut the parallel nerves (*a* and *b*, Fig. 1). He excised a portion of *a* and engrafted the central end of it into the central end of *b*. He at the same time shortened the peripheral end *b* and engrafted it into the peripheral end of *a*. He then sutured the peripheral end of *a* and the central end of *b* together. (Fig. 3.) The results of his experiments, as will be shown by his paper which he is now preparing, and which he has very kindly permitted me to use, are as follows : A bulb or neuroma formed on the central end of *a*, whilst the peripheral end of *b* degenerated. The central end of *b* united with the peripheral end of *a*, through which nerve the impressions were conducted.

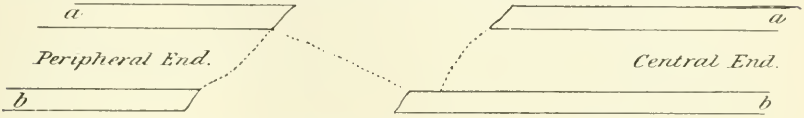

FIG. 2.—Nerve-grafting according to Huber, showing nerves cut ready for implantation.

This experiment corroborated the results obtained by Letievant. It will be observed that Professor Huber in his experiments " broke the circuit," so to speak, of both nerves, *a* and *b*. By his method of cross-suturing he required the impressions of central *a* to pass through a part of central *b*, across the point of suture, before they could reach the peripheral end of nerve *a*. In a similar manner the nerve impressions of central *b* must cross the point of suture and be transmitted through a part of the peripheral end of the nerve *a* before they reach the peripheral end of *b*. At the same time the peripheral end of nerve *b* is practically isolated from the central ends of both *a* and *b*, and is attached to the peripheral end of nerve *a* which has also been cut, and the legitimate consequences are that the peripheral end of nerve *b* undergoes degeneration.

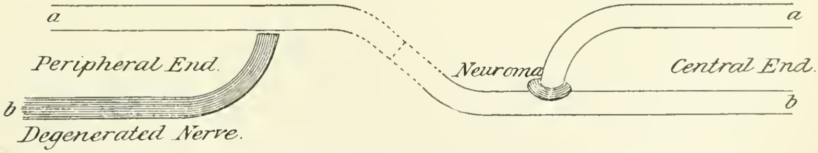

FIG. 3.—Nerve-grafting by cross-suturing, according to Huber.

By the following explanation and diagram, it will be observed that the operation performed by Galbraith is essentially different from either of those performed by Letievant or Professor Huber. To illustrate Dr. Galbraith's operation, we have parallel nerves (*a* and *b*, Fig. 4). Nerve *b* received an injury and the portion represented by the dotted lines is excised, leaving a gap too wide to be sutured or bridged across in any way. By Galbraith's operation, the peripheral end of *b* is infixed into the peripheral end of the uninjured nerve *a*, and the central end of *b* is implanted into the central end of *a*. The results, as shown by Dr. Galbraith, and more recently by Dr. Means, of this city, and by the case detailed in the present paper, where the same operation was performed, were all quite satisfactory, showing that where this operation is performed, the nerve impressions are carried from the central end of *b* through a part of *a* until they reach the peripheral end of *b*, and from there on to its extremity. (Fig. 5.)

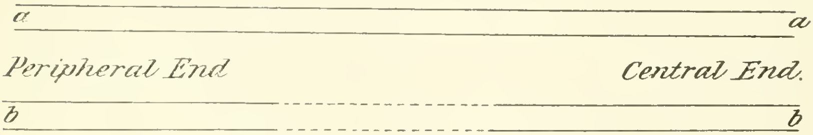

FIG. 4.—Nerves ready for infixation after the method of Galbraith.

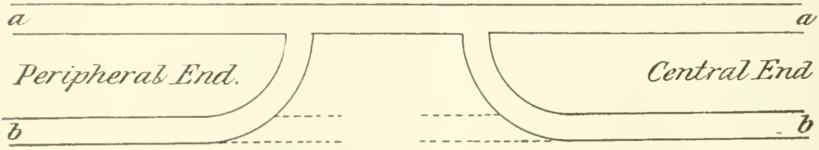

FIG. 5.—Neural infixation after the method of Galbraith.

In harmony with the experiments of Professor Huber, we would not expect the central end of *b* to undergo degeneration, but, instead, it becomes engrafted into the uninjured nerve *a*, and instead of the peripheral end of *b* becoming degenerated and remaining so, it receives nourishment from the uninjured nerve *a*, and if degenerated becomes regenerated and takes on its normal functions, and the result is that the nerve impressions of central *b* are transmitted through a portion of *a* until they reach the peripheral end of *b*, and from there they are carried to the extreme filaments of the nerve.

A patient was admitted to the Protestant Hospital the latter part of December, 1894, for tubercular adenitis involving the axillary glands. There was a large tumor in the left axillary region, nearly the size of a fist, extending to the humeral insertion of the pectoralis major muscle, backward to the serratus magnus and filling the entire axillary space. He was operated on December 28, 1894, and the tumor carefully dissected out, exposing the brachial artery, the axillary vein, and the brachial plexus of the nerves. In spite of all the care possible, we were obliged, during the operation, to cut the circumflex nerve and also the posterior thoracic, which we sutured with catgut. In addition to these we found a large muscular branch which supplied the inner portion of the arm which was given off from the posterior cord more than an inch above the circumflex and was entangled in the tumor to such an extent that it was necessary to excise at least two inches of it; the central end of this nerve was infixed into the central end of the circumflex, while the peripheral end was also carefully infixed with catgut suture into the central end of the circumflex. The cavity was packed with iodoform gauze and the dressing completed in the ordinary aseptic manner.

This operation was witnessed by quite a number of the local physicians as well as a large number of students. The next day I found there was paralysis of the deltoid muscle, together with anæsthesia and paralysis of the inner portion of the arm, extending down the ulnar side to the wrist. There was also anæsthesia found over the territory supplied by the posterior thoracic nerve. For more than a week the nerves were plainly visible in the axillary space when the dressings were changed, but were gradually covered by granulation tissue, and in about two weeks the functions of the severed nerves began to return. He was discharged from the hospital in three weeks and allowed to go home and return for dressing, and was finally discharged in eight weeks, and in nine weeks returned to his occupation as bartender. The patient is now entirely well.

I am well aware that the time elapsing between the operation and recovery is much shorter than that required in the experiments of Professors Howell and Huber. At the same time, there is no question as to the injury of the nerves as above stated, in this patient, while the time required for recovery corresponds with that in the cases of Drs. Galbraith and Means.

I shall not attempt, at this time at least, to explain from a physiological stand-point the regenerative process which took place, but will simply offer the case as a clinical fact, showing the results of nerve suturing and neural infixation. I feel justified, however, in saying that if future work in this direction proves as successful as the scanty experience of the past, it will enable the surgeon to relieve many injuries to the nerves which heretofore have remained permanent.

# FLOATING BODIES IN JOINTS.

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BY floating bodies in joints, or, as they are frequently termed, joint mice, we mean bodies of varying structure usually composed of bone, cartilage, masses of fibrin or fat, or fibrous tissue which are either loose in the joint or are attached to some part of the joint surface by pedicles. By far the greater part of these bodies is found in the knee-joint, so that when we speak of joint bodies we usually refer to the knee as the seat of disease. They next in frequency are found in the elbow-joint, and rarely in the ankle and wrist. The explanation of their frequent occurrence in the knee-joint is that the joint has a very large surface, and that by its position it is greatly exposed to traumatism.

The first systematic study of these bodies was made about 250 years ago by Pechlin, a Swedish surgeon. Since then numerous cases have been reported and a great many theories advanced in explanation of their origin. Of late years, careful microscopical examination of specimens removed by operation, and found on post mortem, has done much to clear up doubtful points in the etiology of these peculiar bodies.

As an introduction to this paper, I will report three cases which have lately come under my observation.

Case I.—Mrs. E. J. S., married, aged fifty years. In January, 1893, suddenly (while walking about the house) was seized with a sharp pain in left knee, which was so severe that she fell at once to the floor. The knee immediately became swollen and remained fixed in one position until seen by me the same evening. While examining the knee something seemed to give way; immediately afterwards the joint could be moved. The symptoms of an acute serous synovitis, which was treated by application of cast, presented for about three weeks, when they disappeared. During the following two years she had four similar attacks, the only difference being that the initial symptoms were not so marked. There was no history of trauma, nor of an antecedent joint-disease, and no evidence of chronic rheumatic arthritis.

Examination of the joint made from time to time showed the knee slightly swollen, passive movements limited, and slight crepitation. To the inside of patella could be felt a hard body that was movable over a limited portion of joint. Palpation of this body caused severe pain.

*Diagnosis.*—Floating cartilages in the knee-joint. Operation March 21, 1895. Under ether anæsthesia an incision to the inside of patella, three inches in length, was made through the skin, subcutaneous tissue, and capsule. During the operation the body felt to the inside of the patella slipped away. On opening and exploring the joint three floating cartilages about the size and shape of small olives were found and removed. Careful exploration showed the capsule thickened, but no defects were found in the articular ends of the bones. Suture of the capsule with catgut, the skin with silkworm gut, with subsequent antiseptic dressing over which was applied a plaster cast. The dressing was removed at the end of a week, and perfect primary union was found. Recovery followed with perfect use of the joint. Microscopical examination of one of these bodies showed it to be made of successive layers of cartilage and calcareous material, the latter closely resembling bone; no fibrous tissue or remnants of the pedicle could be found.

Case II.—Fred. B., German, aged forty-nine years. Family history negative. Never had any severe illness. When about eighteen years of age he injured his right knee by striking it with an axe. This accident did not produce any marked symptoms at the time. About six years later he noticed a small movable body to the inner side of the patella. At the time he first noticed the loose body it was about the size of a ten-cent piece. He has been more or less disabled by its presence ever since (for thirty years). At times it would become fixed between the anterior surface of the tibia and the capsule, or underneath the patella, causing locking of the joint. He soon learned how to dislodge it, when the joint would return to its former condition. The patient entered the Post-Graduate Hospital in April of this year for the purpose of having the body removed. Examination showed the right knee to be considerably larger than the left; the thigh- and leg-muscles on that side are considerably atrophied. On measuring the femora the right is found three and three-fourths centimetres longer than the left. To the inner side of the patella there is a large loose body which can be freely moved to any part of the joint. The leg being prepared in the usual way, an incision two inches in length was made to the outer side of and along the patella parallel to the extensor tendon, the loose body was pushed up to this point and removed through this opening. The capsule was subsequently sutured with catgut and the skin with silkworm gut, the usual antiseptic dressing being applied, and the leg encased in a plaster cast. The wound healed by primary union, but the joint remained somewhat stiff. The body when removed measured $1 \times \frac{7}{8} \times \frac{3}{5}$ inches, was concavo-convex, the convex side being composed of cartilage which overlapped the concave bony surface. The examination showed the cartilage to be of the hyaline variety and the bone spongy without any fibrous tissue being present.

Case III.—John O., Dane, aged nineteen years. Admitted to Cook County Hospital May 9, 1891. Patient states that for several months he has had trouble in his right knee. He would suddenly, while walking, be seized with severe pain in the knee, which would occasionally cause him to fall to the ground. Patient unable to speak English, therefore a full history cannot be obtained, but he says that about a year ago he injured the knee.

*Operation.*—Dr. Fenger. Ether. Rigid antisepsis. A longitudinal incision to the inside of patella, about three inches in length. After exploration a loose body was found on the anterior and external aspect of the joint and removed. On the outer semilunar cartilage a defect was found which corresponded in size to the piece of cartilage removed. Joint was irrigated and drained with rubber drainage-tubes; capsule and skin sutured separately with silk suture. Antiseptic dressing and plaster-of-Paris cast. Prompt recovery, with complete restoration of function. No microscopical examination of specimen made.

*Etiology.*—The cause of loose bodies in the joints has been a much-disputed question. Of late considerable advance has been made in determining the exact causation of individual cases. In the past, most writers ascribed a common cause for all these bodies, whereas we now know that there are a number of factors concerned in the etiology, and different cases have a variety of modes of origin. Exact clinical histories with careful classification on a histological basis have done much to clear up many mooted points in the etiology of these peculiar bodies. Using Volkmann's general classification, we have (*a*) those that are found in otherwise healthy joints, the disease, if any be present in the joint, being only that occasioned by the presence of these bodies; (*b*) those that are found in diseased joints.

Under the first general head we have the following subdivisions: (1) Those that are purely of traumatic origin. These may be made up of (*a*) cartilage alone; (*b*) bone; (*c*) bone and cartilage combined. Of those that come under this head there are but few. I might say that in a careful review of the literature of the subject, I found only three cases, one of which is doubtful. I do not include in this class the cases of detached semilunar cartilages which are sometimes completely separated by traumatism and act as loose bodies, but only those cases of completely separated pieces of the articular ends of the bones. Experimental researches regarding the production of loose bodies in the joints, especially those of Kragelund, argue decidedly against any parts of the joint-surfaces being separated immediately as the result of traumatism. Kragelund found that in no case could complete separation of a piece of bone or cartilage be produced by violence applied to a dead body; that pieces loosened in this way had to be removed with forceps later in order to entirely free them from their attachments. It is easy to see how pieces of bone or cartilage, or both, might be separated at the point of attachment of the ligaments, but such pieces would not act as loose bodies. König maintains that immediate separation o bone or of cartilage as a result of violence applied to the articular ends of the bones never occurs, and that there are no authentic cases of this kind on record.

O. Volker reports the only case of purely traumatic origin of loose bodies in which the patient survived the injury. His case was that of a soldier who injured himself by stepping into an excavation. The accident was immediately followed by swelling of the knee and complete loss of function. Examination immediately after the injury under chloroform showed the presence of a loose body. An operation was performed a few days later, and blood was found in the joint together with a loose body consisting of bone and cartilage, the osseous side of which showed evidences of being recently split from the articular end of the femur, a corresponding defect being found on the internal condyle.

Fischer reports a case of purely traumatic origin. The patient, a male, was forty years of age, and fell from a distance, sustaining injury, from the result of which he died a few days later. On section, a loose body was found in the right elbow-joint, which corresponded to a defect on the anterior surface of the olecranon. No diagnosis of fracture was made before death.

In Feurer's case, cited by Real, where a young woman had fallen from a stool, striking on the knee, there was immediate swelling and loss of function. Two and a half weeks later a body was found in the joint. Operation showed it to consist of cartilage and bone, the osseous portion having a clearly-defined split surface. Real regards this as a case of immediate separation from trauma, but the time (two and a half weeks) which elapsed after the injury before the body was found would be sufficient to allow of another explanation of its origin. Most of the cases reported by Hasse, Bischet, Hadder, Lany, Real, and others, which are said to be purely traumatic in origin, are open to the same criticism, and do not belong to this class. In order that we may place any individual case in this category, we must have the following conditions:

(1) There must have been sufficient violence to break off a piece of the articular ends of the bones. This, as we have seen, is considerable.

(2) There must be a loose body found immediately after the injury.

(3) The body must correspond in size and general contour to the defect found in the bone at the time of operation.

(4) Microscopical examination of the body must show it to be made of normal cartilage and bone, or of cartilage alone. Unless we have all or most of these conditions present, we are not in a position to assume that the body was the immediate result of violence.

The structure of these loose bodies which originate in this manner corresponds to normal bone and cartilage; in most of them we find both bone and cartilage. If purely cartilaginous, they are of the hyaline variety, and their shape shows them to be pieces separated from the joint-surface. They are never enveloped in a fibrous capsule, but may, as the result of friction or degenerative changes, be materially altered in their form and appearance.

(2) Loose bodies composed of separated pieces of cartilage or of bone that were not broken off at the time of injury, but which became detached later. The pathological condition that leads in this way to the formation of loose bodies, has been carefully studied by König under the name of "osteochondritis desiccans," and then later by Poulet and Villard without their giving it any name. It was also recognized by Paget, who called it "quiet necrosis." Its cause is unknown. All that we know about the disease is that (1) it may follow a traumatism; (2) it may originate spontaneously; (3) it may develop at any period of life; (4) small pieces of the articular ends of bones may be loosened as the result of the disease, causing floating bodies; or the whole articular end of the bone may separate, as occurs sometimes in the hip- and shoulder-joints.

In this paper the consideration of this pathological condition only interests us in so far as the disease bears a causal relation to the presence of loose bodies in the joint; and that it frequently does so is evidenced by two of König's reported cases in which he found incontrovertible evidence of a chronic inflammatory process (infiltration of the round cells, etc.), both in the loose bodies and at the place of separation. In all he reports eight cases of loose bodies, three of the elbow, five of the knee, in only two of which was there a history of trauma. In all defects were found in the bone corresponding with the size and shape of the loose bodies. In none were there any signs of arthritis deformans or of tuberculosis. As previously stated, most of the cases reported, to which trauma was the assigned cause, can only be explained by supposing that the trauma acted indirectly by interfering in some way with the nutrition of the parts, the separation occurring later as the result of this disturbance. In a great many cases there is no history of trauma. In these we know nothing of the cause of the chronic osteitis that determines the separation of pieces of cartilage or bone from the articular surface of the joint. The loose bodies that result from the so-called osteochondritis desiccans are usually made up of cartilage alone or of bone and cartilage combined. They have a more or less circular outline, are generally concavo-convex, the convex side corresponding to the articular surfaces of the joint, and composed of hyaline cartilage. They have been in the joint for some time; they are usually worn smooth and facetted where they have come in contact with the bony parts of the joint. They may be multiple, but are usually few in number, not more than three or four, and are frequently single. It is not necessary that they correspond accurately to the defects in the joint-surfaces, or that there need be defects at all; as these are occasionally completely obliterated by a process of regeneration, the bodies are frequently changed in form by retrogressive metamorphoses. As König has shown, they frequently present evidences of inflammatory process within the joint. Another point mentioned by Poulet and Villard is that the disease is frequently symmetrical, affecting homologous joints. Bowlby reports such a case where two loose bodies, one from each knee, composed of hyaline cartilage, in which the cartilage cells were arranged irregularly, were removed from a boy eighteen years of age. There was no history of injury to the joint, nor any evidences of disease other than a recurring synovitis occasioned by the presence of these bodies. Clutton reports a case similar in every respect to this one. The disease most frequently attacks the knee, but may occur in any joint. König reports three cases of this kind, all occurring in young people, and affecting the elbow-joint. There was no history of injury in any of the cases.

(3) Loose bodies originating from hæmorrhage into a sound joint as the result of a traumatism. Cases coming under this

head are exceedingly rare. The characteristic features of such cases are (1) they follow some time after an injury to a joint where there are evidences of hæmorrhages into the joint. (2) That the symptoms are severe for a time, usually lasting from one to three years, and that they subsequently disappear spontaneously and complete recovery follows. Hunter claimed this to be the most frequent mode of origin of joint bodies; but only three cases are reported.

Gurlt mentions one case the formation of which occurred by a small blood clot becoming impregnated with lime salts. Fischer reports one case where a soldier fell from a horse, striking on the flexed knee. Immediately profuse hæmorrhage into the joint followed. Five months after the injury the patient was suddenly seized with a sharp pain in the knee, with fixation of the joint and inability to straighten or flex the leg. Under chloroform narcosis a large loose body could be felt inside of the patella. The patient refused an operation, and so he suffered for two years with recurring synovitis, and all the while could feel the body in the joint. A year later, or three years after the accident, when Fischer examined him the body had disappeared. Recovery followed. Shattock's case might be placed in this list. He reports a case of pedunculated body 4 x 3 x 7 centimetres, situated underneath the patella of the left knee-joint. The body was removed, and on microscopical examination it was found to be made up of a finely intercommunicating trabeculæ, resembling fibrous tissue, into which was dispersed a fine reddish-brown pigment with some red and white blood-corpuscles. He regards this as an example of an attempt at organization of blood clot. The hæmorrhage evidently took place into the superficial layer of the synovia. Bowlby reported a similar case where a hæmorrhage into the synovial fringe was the cause of a pedunculated floating body.

(4) Loose bodies caused by drawing into the joint of a foreign body embedded in the capsule. Large foreign bodies, such as bullets, may remain in the joint cavity for some time without causing much disturbance and act as nuclei for the formation of loose cartilages, but, as a rule, they cause symptoms

which call for their early removal. If embedded in the capsule or near the articular surfaces of the bones they may stimulate the proliferation of cartilage cells so as to cause enchondroses, which subsequently break off or become pedunculated. This is more frequently the case when the body is small. A case of this kind was observed by Shaw, where an osseous cartilaginous pedunculated body having embedded in its centre the point of a needle one-twelfth of an inch in length was found in the knee-joint of a young woman. The pedicle was attached to one condyle of the femur. The central portion of the body was composed of bone around which was a layer of cartilage, the whole covered with a thin layer of fibrous tissue.

(1) Under the second general heading where loose bodies occur in diseased joints, by far the most frequent are the so-called corpora oryzoidea, which are found in tubercular hydrops articuli and so-called hydrops fibrinosis of Volkmann and Ranke. These are known sometimes to follow trauma, but not usually. They are found in large numbers and originate in one of three ways: (1) As pure concretions. (2) By desquamated epithelium forming nuclei upon which is deposited several layers of fibrin. (3) Sometimes they are simply detached villi, which enlarge by accumulation of successive layers of fibrin, or by swelling and by degenerative changes taking place. The joint capsule in these cases presents the characteristic changes that are found in any similarly diseased joint, —that is, the presence of the bodies does not induce the changes in the joint as in the other cases considered. As a rule, they do not produce the common symptoms of loose bodies in the joint, partly because of their size, and partly for the reason that the underlying pathological condition produces symptoms that obscure those occasioned by loose bodies.

(2) Bodies that originate from cartilaginous metamorphosis of the synovial membrane or of the fibrous layer of the capsule which are subsequently drawn into the joint and remain either attached by a pedicle or become detached, forming free bodies. This is a relatively frequent cause of loose bodies in the joint.

As a rule, they remain attached to the capsule, but are sometimes found free. Laennec in 1813 first described the formation of movable bodies by this process. Volkmann has reported several cases where bodies were found both free and attached to the capsule.

The various stages of their development have been carefully studied by Gurlt in his work on the "Pathological Anatomy of Joint-Disease." In this work are cuts illustrating the origin of these bodies and showing their various stages of development.

Virchow observed a case where two of these bodies were found free in the joint cavity, and three attached by pedicles of varying thicknesses. The pedicles usually become more attenuated and finally are detached, leaving the bodies free in the joint. These bodies are usually biconvex, one side being cartilaginous, the other bony, the cartilage overlapping the bone. In the larger the osseous elements predominate. These are, as a rule, free. The smaller ones are usually pedunculated, the pedicles being devoid of blood-vessels. Cases of loose bodies originating in this way are reported by Klein, Fischer, Delgarde, and Schmidt.

(3) Loose bodies resulting from pathological changes occurring in normal joint villi with subsequent detachment of these villi. Rokitansky was the first to show that degenerated joint villi were a frequent cause of loose bodies in the joints, although the so-called lipoma arborescens was earlier described. Volkmann has shown that in most chronic joint inflammations proliferation of cartilage cells takes place on the swollen ends of the villi, or they become calcified, and are subsequently loosened by being caught between the articular ends of the bones. Rokitansky believes all cartilaginous joint bodies are formed in this way, as the normal villi contain cartilage cells which proliferate, and may or may not be impregnated with lime salts. Fischer thinks this theory explains a few, but not all, of the cartilaginous bodies found in joints. Those that are composed of hyaline cartilage with or without calcification, and that have no fibrous capsules and no remnants of a pedicle, he regards as formed in this way. These, as before mentioned, are usually associated with a chronic inflammation of the joint, and are usually multiple, and are, as a rule, reniform in shape and very elastic.

Simon observed a case of sarcoma of a villus which had become detached and formed a loose body.

(4) Loose bodies that occur in arthritis deformans. These are not common. Recklinghausen in 1865 reported a case. They are usually composed of bone, being more or less covered with cartilage and of irregular shape and uneven surface. The characteristic condition found in other joints in this disease will be sufficient upon which to base a diagnosis.

The question of the growth of these bodies that are free in the joint is of some interest. Cases are recorded where the growth during the course of years has been noticed both by the patient and the surgeon. In one of my cases (Case II), the patient, an intelligent man, says that he first noticed a movable body in his knee, which was smaller than when removed. It is generally conceded that they sometimes grow, but the exact way in which they grow is still not clearly understood. Virchow thinks that it is possible for them to increase in size in two ways : (1) by deposition of successive layers of fibrin ; (2) by proliferation of cartilage or bone-cells that are originally present in the body, the nourishment being supplied by the synovia. The latter is the way in which pedunculated bodies, as well as free bodies, grow. The fact that the pedicle never contains any blood-vessels shows that the nourishment must be derived from the synovial fluid. Poncet mentions that the increase in size is due to degenerative changes, a proposition that is not sustained by any other evidence.

*Symptoms.*—As a rule, disturbances produced by loose bodies in a joint are sufficiently prominent to enable an early positive diagnosis to be made. The first and most prominent symptom of loose bodies in the knee is a sudden locking of the joint, usually in the position of nearly complete extension, and it may remain in this position for several days, any attempt to change it causing severe pain. The cause of this is the presence of the body between the anterior surface of the bones and the capsular ligament.

But immediately following this we have an acute synovitis which lasts from one to four weeks. These symptoms recur at longer or shorter intervals. Usually there are three or four attacks during the course of a year.

On careful examination there will be found a loose body in the joint, frequently on the inner side of the patella. In the elbow-joint a recurring synovitis with inability to completely straighten the arm are the most prominent symptoms. In these cases the body usually lies on the anterior surface of the joint, between the capsule and the surfaces of the articular ends of the bone. Limitation of motion is present in all cases. Crepitation is usually present and is caused by a thickening of the capsule. Lengthening of the femur on the side of the affected joint has been tested. This was found in two of Real's cases and in one of my own. In all the tibia and fibula were of equal length in the two limbs, and the bones were otherwise normal. There are no other observations on this point recorded. In one of Real's cases a lengthening of two centimetres is recorded, in the other one and a half centimetres. In my case there was present a lengthening of fully three centimetres.

The cause of increased development of the bones has been carefully studied by Poncet and Bidder. We know that an inflammatory condition of the periosteum or of the bone itself, or any inflammation in close proximity to the bone, will stimulate the growth of bones both in thickness and length, when inflammation is present during the growing period of life. Clinically this has been frequently observed. Langenbeck reports a case of lengthening of the femur of two centimetres which occurred within two months. As previously stated, this is the only course that the disease takes on before the bones are fully developed. In young individuals any inflammatory disease of the epiphyses will limit the growth, while if the shaft be the seat of the disease increase in length will occur. Inflammation in one bone may also cause an increase in length of the neighboring bones. Langenbeck mentions a case where the tibia was the seat of osteomyelitis in which an increase of three centimetres in the femur of the corresponding side was noted. The same occurrence has been observed where the radius was the seat of osteomyelitis causing an increase in length of the ulna on the corresponding side.

The case of Broca, cited by Langenbeck, where an aneurism of the femoral artery stimulated the growth of the femur, proves that an irritant, not necessarily of an inflammatory nature, may cause an increase in length of the long bones. The cause of lengthening where floating bodies are present may be explained by the irritation of the articular ends of the bones, caused by the presence of these foreign bodies. This can only take place when the body is in a joint during the growing period of life. In my case the body was present for thirty years.

*Diagnosis.*—The diagnosis, when the previously-mentioned symptoms are considered, is usually very easily made. The body is frequently felt by the patient himself, who makes the diagnosis before consulting a physician. The sudden occurrence of pain in a joint otherwise healthy, with fixation in some position, or the sudden onset of an acute synovitis with no other apparent cause, will be sufficient ground upon which to make a probable diagnosis. The finding of the movable body in the joint generally makes the diagnosis positive, although in a few cases the body is never felt during the examination.

*Treatment.*—It may be of historical interest to mention some of the methods of treatment that were employed in pre-antiseptic days. Chassaignac mentions the following methods that were employed:

(1) *Palliative.*—(*a*) Fixation of the loose body by compression, so that it may become attached to the capsule; (*b*) fixation by passing needles through a part of the capsule; and (*c*) fixation by subcutaneous ligature.

(2) *Radical Methods.*—(*a*) Removal through direct incision; (*b*) incising the skin and capsule at different levels; (*c*) through subcutaneous operations performed at two sittings, the skin from a distance being displaced over the body; incision made through the skin and capsule, the body allowed to escape into the subcutaneous incision, from which it was removed at a later time after the capsule had healed.

During the pre-antiseptic period the mortality connected with these radical methods of treatment was very high. Bell recommended amputation in those cases where an operation was indicated, in preference to opening the knee-joint. The mortality at this time was about 33 per cent., and of those who escaped with their lives a great number went through life with a more or less ankylosed joint, as a result of septic infection. It is scarcely worth while to mention that the only method of treatment of to-day is to remove these bodies by direct incision. The limb should be carefully prepared twenty-four hours before the operation, and covered with a wet antiseptic dressing. The operation should be performed either with the patient under the influence of a general anæsthetic, or preferably by the use of local anæsthesia. In one of the cases that I have reported, the operation was performed without the slightest discomfort to the patient with Schleich's method of cocaine anæsthesia (.02 per cent. solution). The advantage of this method is that the patient can assist in finding the body in case it should escape during the operation, and there is absolutely no danger connected with the use of cocaine when employed in this way. After the loose body or bodies have been removed, the joint capsule should be sutured with fine catgut and the skin with silkworm gut. No drainage or irrigation should be employed. The mortality should be *nil*, and if septic infection is prevented, which is possible in every case, there is absolutely no damage done to the joint by the operation. Healing is usually complete at the end of a week, when the patient should be able to walk without any pain or stiffness of the joint.

## Remarks on the Reported Cases.

In Case I there is nothing unusual. It presents the features common to most of those of the class to which it belongs. Without doubt, these bodies originated from changed and subsequently loosened joint villi. That this was the way in which these bodies originated is evidenced by the following:

(1) The shape of the body. Three were similar in size and shape, all about as large as small olives.

(2) Structure. They were composed of hyaline cartilage, arranged in concentric layers, the centre and intermediate substance being calcareous deposit.

(3) The chronic inflammatory condition of the joint, which is shown to have existed for some time by the thickening of the capsule. We know that usually, when detached villi are the cause of loose bodies, the joint is the seat of a chronic inflammation.

(4) No defects were found in the articular surfaces of the bones.

Cases II and III represent that class that originates by separation of pieces of the articular cartilage, or of the cartilage and bone, the result of the so-called osteochondritis desiccans, the trauma occurring some time before the pieces separate. In Case II no defect was found in the joint surface, but, as mentioned in Case III, a small defect was found on the outer margin of the semilunar cartilage, corresponding in size and shape to the loose body.

## CONCLUSIONS.

(1) That the etiology of some of these bodies is yet not fully understood; but that the condition described by König under the name of osteochondritis desiccans explains the most of those that are found in otherwise normal joints. This deserves further investigation.

(2) That few, if any, are the direct result of violence.

(3) That the most pronounced symptom is the sudden onset of severe pain in the joint with locking of the joint, usually in a nearly extended position, this being followed by acute inflammatory process in the joint involved.

(4) That lengthening of femur (in movable bodies in knee) may occur as a result of irritation produced by the pressure of these bodies.

(5) That the only treatment for this condition is the removal by direct incision, preferably under cocaine anæsthesia, as soon as diagnosis is made.

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# THE NAVEL LOOP.

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THE bowel and mesentery belonging to the superior mesenteric artery compose the digestive tract which extends from the flexura duodeno-jejunalis to the flexura coli lienalis (sinistra). The parts of the bowel included in this arterial blood-supply are the jejunum, ileum, appendix, cæcum, ascending and transverse colon, and the mesenteries included are the mesenterium and mesocolon transversum. The normal ascending colon of man has no mesocolon. The bowel loop supplied by the superior mesenteric artery has various designations given to it by different writers. It is called the primitive loop, the great intestinal loop, or navel loop (Nabelschleife). His proposed the name mesenterial bowel (mesenterial darm). This term of His is not apt or natural, as other portions of the bowel possess a mesentery, as the meso-sigmoid. This loop has at the anterior end the flexura duodeno-jejunalis and at the posterior end the flexura coli lienalis. It is not bordered by valves as other segments are, but by flexures. In man, it appears to me, the term navel loop is the most natural and expressive, for, so far as I am able to discover, man is the only animal in which this bowel loop, during embryonic life, protrudes at the navel and returns to the peritoneal cavity about the eighth week of gestation. Hence, we shall term the part of the digestive tube supplied by the superior mesenteric artery the navel loop. It is almost exclusively the part of the tract which is engaged in the peculiar phenomenon of rotation brought about by growth changes. It may be noted that the navel loop is divided into three very distinct portions,—viz., small intestines (jejunum and ileum) which have a well-marked mesentery; an ascending colon with no mesentery, and a transverse colon with a distinct mesentery. This loop is fixed in the middle and free at either end. Its fixations, like all other bowel attachments, are on the unmovable abdominal dorsal wall, not on the movable anterior abdominal wall. The mesentery of the navel loop begins at the flexura duodeno-jejunalis, or the lower border of the pancreas, or at the second lumbar vertebra, and it is very firmly fixed at this point, especially by the musculus suspensorius duodeni (of Treitz). This fan-shaped muscle with considerable connective tissue should rather be termed musculus suspensorius mesenterii, as both muscle and connective tissue spread out like a fan in the mesentery of the small and large bowel. From the flexura duodeno-jejunalis the mesentery passes downward from left to right, crossing immediately in front of the great blood-vessels, which lie against the vertebral column, to an uncertain ending in the right iliac fossa. This mesentery has no length at either end, but is longest in the middle, averaging about six inches. The middle seven feet of bowel possess the longest mesentery. This part is apt to be found in hernia from its elongated mesentery. From the uncertain ending of the mesenterium in the right iliac fossa the ascending colon continues upward without a mesentery. The posterior third of the ascending colon is deprived of its shining epithelial layer. It continues over the right kidney to the under surface of the liver, where it makes an obtuse bend to become the transverse colon. The line of insertion now becomes the mesocolon transversum and stretches across the body parallel to the lower border of the pancreas to the flexura coli lienalis,—*i.e.*, to the ligamentum phrenico-colicum. Thus it is seen that only two portions of the navel loop have a mesentery,—the small bowel (mesenterium) and transverse colon (mesocolon). The peculiarity of the navel loop is that in embryonic life it had a free common mesentery (mesenterium commune), but with axial rotation, changes produced by growth process, the middle portion of the navel loop (ascending colon) lost its mesentery, and became fixed to the posterior abdominal wall. The neck of this navel loop began at the root of the superior mesenteric artery, and preserves almost its original position in adults, except that the flexura coli lienalis has shifted to the left and become engaged in the folds of the great omentum, or, in other words, the ligamentum phrenico-colicum. Another peculiar phenomenon of the great navel loop is the rapid increase in length which takes place in that part of the loop known as the small intestines or jejunum and ileum, while the part of the loop known as the ascending colon and the transverse colon grows very slowly. The vigorous and extensive blood-supply to the small intestines destines this part to grow rapidly in length and to assume the chief business of digestion in man. The small intestine grows so rapidly in length that it is compelled to assume a folded or ruffled appearance. The enormous liver in early embryonic life forces the small intestines into the left iliac region. In examining human embryos from three to four months' old these phenomena can all be noted. It is to be observed that in the third and fourth embryonic months the peculiar growth changes affected by intestinal rotation are chiefly seen on the anterior or left side of the mesoduodenum. The colon ascendens loses its mesocolon mainly through the rapid growth of the kidney. The real mesoduodenum—*i.e.*, the membrana mesenterii propria—is present. It has only been deprived of its shining covering of epithelial cells on both sides, yet the anatomical mesoduodenum, the membrana mesenterii propria, the real neuro-vascular visceral pedicle is never absent. It is essential to the life of the spiral-shaped duodenum. In all the changes effected by growth and rotation of the digestive tract the cæcum never loses its complete covering. Not once in over 200 autopsies did I find the cæcum uncovered by peritoneum. We have thus been talking of a very free small intestinal mesentery of a fixed colon ascendens and a free mesocolon transversum. The mesocolon transversum is simply the continuation of the mesocolon descendens and ascendens. The blades of the mesocolon transversum divide at their insertion on the dorsal wall to receive the body and tail of the pancreas. The anomalies of the navel loop and its mesenteries are not very rare. In some over 200 autopsies I noted perhaps ten or a dozen. In the first place, it appears to me that these anomalies arise chiefly from inflammation occurring during early embryonic life, say between the eighth and sixteenth week. The process of bowel rotation has been checked by peritonitis. In fact, it appears to me that peritonitis is the chief cause in abnormalities or arrest of development in the navel loop. The first and most common anomaly of the navel loop is that of non-descended colon. The second is that of excessive descent of the colon. The third anomaly is that known as mesenterium commune. In non-descent of the cæcum one may find the cæcum at any point from the under surface of the liver to its natural position. Dr. Waite and I operated on a man of thirty for appendicitis, where the cæcum and appendix lodged immediately under the surface of the liver and the appendix ruptured near the gall-bladder. In 100 autopsies I noted four cases of non-descended cæca. So far as my observations are concerned, it appears that the arrest of the descending cæcum was due to embryonic peritonitis from careful examination of the surrounding peritoneal cicatrices. The axial rotation of the navel loop became checked by some kind of inflammatory process.

As regards excessive descent of the cæcum, I shall not attempt any explanation. However, it is a frequent occurrence to find the cæcum so excessively developed or elongated that it lies on the pelvic floor. Concerning the mesenterium commune, I have noted two complete cases in adults in 100 autopsies, but as many as four to six cases of incomplete mesenterium commune. In some twenty-five human infants and embryos I found one complete mesenterium commune once and partial several times. Whether a child will survive without any mesentery in the navel loop is very doubtful yet. Lawson Tait reports cases without a mesentery. It is doubtful whether the individual will continue existence without a peritoneum, and at this point I would call attention to cases where the bowel seems to lie in loose connective tissues. By careful separation in such cases one can soon find the old peritoneum acting as supports to the gut. I saw two such cases where the whole intestine was buried in a fine white, snow-like bed of connective tissue.

Dr. La Count suggested that it might be called senile peritonitis, yet this term would not indicate the situation. It was more like a wonderfully excessive development of connective tissue very much resembling the subperitoneal tissue. As regards the length of the navel loop, it may be found to vary widely within normal limits. We have found this loop in the adult thirty-four feet long and twelve feet long,—varying as much as twenty-two. It is common to find it vary ten to fifteen feet The part of the navel loop which especially varies is the jejunum and ileum. The next portion to vary in length is the transverse colon. The ascending colon is quite constant in length, unless the abnormality of non-descent of the cæcum or mesenterium commune occurs.

On page 519 of Meckel's pathologic anatomy several cases are mentioned of extremely short navel loop. He quotes Cabral, who observed in a forty-year-old man a digestive tract reaching from stomach to rectum without intestinal coils. The canal was barely **S**-formed and was four spans long, but very wide. There was no pylorus or separation between stomach and duodenum. Another case is Bellot's, quoted, where the gut was scarcely longer than the body. In Dionis' case the digestive tract reached from stomach to rectum and in almost a straight line. Meckel observed that these subjects with an abnormally short digestive tract were afflicted with very much hunger. This accords with my experience in shortening a dog's digestive tract by anastomosing the stomach to the rectum. In such cases the dog is compelled to eat much of his time to keep his body nourished, for the food passes through so quickly that little absorption can take place. I had one dog who seemed to eat nearly all the time he was awake, and yet really died of starvation, from an excessively short digestive tract. It may be observed that the colon descendens varies as the transverse does at the right side, for the hepatic flexure is a constant affair. Of course, the most numerous anomalies arise in the secondary or acquired position of the colon ascendens and its mesentery. This fact is the same whether we consider the ascending colon acquires its position through coalescence or through peritoneal displacement. The position of the colon ascendens is wholly acquired in the adult, and it is for this reason that it has so many abdominal deviations which are due to arrest of development,—in other words, the abnormality is due to the checking of axial rotation of the navel loop from adhesive peritonitis. The result is a partial or complete mesenterium commune. I have frequently noted that the lower end (say two to four inches) of the ascending colon is liable to possess a mesentery of a more or less rudimentary character. The great landmark or standard of test of the navel loop is the arteria-mesenterica super, for the superior mesenteric artery is responsible for its long intestinal tube and its vast mesentery. At a very early embryonic stage of life the artery appeared in the midst of the mesentery of the loop. Its branches spread out from it like a fan, exactly in the middle line of the body, antero-posterior. But in the adult the artery has a very different position, for its branches (vasa intestini tenuis) pass towards the left and its trunk passes behind the pancreas and in front of the duodenum. In the adult the superior mesenteric artery arises from the aorta below the cœliac axis. It passes downward, posterior to the pancreas and anterior to the transverse portion of the duodenum. As soon as it emerges from behind the pancreas the small intestinal branches (arteriæ intestinalis), ten to fifteen in number, pass to the left to supply the jejunum and ileum. Towards the end of the ileum, and beginning of the ascending colon, the ileo-colic artery passes to supply the said region. We then note an arteria colica dextra, media, and sinistra. How did this vast digestive artery acquire such a position in adult life? The artery passes behind the pancreas because the atrophying liver has dragged the duodenal loop with the pancreas in its mesoduodenum to the right. The artery passes before the lower end of the duodenum because the duodeno-jejunal flexure is fixed on the backbone near the cœliac axis by the musculus suspensorius duodeni (of Treitz). Of course, considerable connective tissue exists in this support, which I will name ligamentum mesenterii superior. Hence, when the liver drags the duodenum and mesoduodenum to the right, the pylorus, and especially the flexura duodeno-jejunalis being fixed, they retain their original position, while the artery itself is dragged sufficiently to the right to pass entirely to the front of the lower end of the duodenum. The final distribution of the arteriæ intestinalis is due to rotation of the jejunoileal portion of the navel loop to the left, while the colic distribution is due to acquired positions of the ascending colon and transverse colon. It might be thought that a good term for the mesentery of this loop would be the free mesentery of the arteria mesenterica superior, but as some of its original free mesentery is finally not free (ascending colon , it would not be a natural term.

In some cases the mesenterium commune of the navel loop is not only entirely free from the flexura duodeno-jejunalis to the flexura colic lienalis, but the duodenum has a free mesoduodenum and the stomach has a free mesogaster, as well as the arteria mesenterica inferior has a free mesentery from the splenic flexure to the rectum,—*i.e.*, the usual mesenterium commune, the whole bowel, is free from pylorus to rectum, as in the dog and cat, but in extraordinary cases the digestive tube is free from the cardiac end of the stomach to the rectum. The navel loop with a free mesentery or mesenterium commune is possessed of remarkable mobility. It would easily herniate from elongated mesentery. It could easily become involved in volvulus from rotation on its mesenterial axis. In regard to the mobility of the navel loop, I observed in the examination of over 100 autopsies several matters which deserve consideration. The first of which will concern the ligamentum hepato-colicum. This ligament extends from the flexura coli hepatis to the gall-bladder. It is a continuation of the ligamentum hepato-duodenale. It may not be present at all, or it may be present so extensively that it contains the gall-bladder entirely within its folds.

In cases where the gall-bladder lies between its blades it could easily conduct a gall-stone between its plates into the lumen of the colon without rupture of the peritoneum. There can be no doubt that the ligamentum hepato-colicum has saved many a victim subject to gall-stone rupture by circumscribing the invading infection by its folds and barriers. The ligamentum hepato-colicum limits the movements of the colon, and hence the mobility of the whole navel loop. How frequent the ligamentum hepato-colicum occurs is impossible for me to say, yet one sees ten to fifteen in 100 autopsies. In this group of cases the colon is held at its right flexure quite close to the liver, and the cæcum is occasionally apt to be slightly higher than usual. Another band which we examined a large number of times is a fold or band of the peritoneum, which extends from the junction of the upper or middle part of the ascending colon to the right abdominal wall. This limits the motion of the ascending colon. It appears to be due to the right lower border of the liver, and is in all respects similar to the ligamentum phrenico-colicum on which the spleen rests. I would suggest the name ligamentum phrenico-colicum dextra for this band of peritoneum. In most autopsies it is surrounded by adhesions, which seems to me to be due to the irritation produced by the liver in respiratory movements. In another set of cases there is no ligamentum hepato-colicum, and the flexure coli hepaticum is considerably removed from the liver, and, besides, is very much increased in mobility. The ligamentum phrenico-colicum dextra and ligamentum hepato-colicum may both be absent or present in various sizes. It does not appear that there is any relation between the two ligaments as to presence or absence. One may be present and the other absent. In visceral prolapse both of these peritoneal folds may be very much elongated, but the elongation does not affect the ligamentum hepato-colicum generally very much, as the pylorus descends with the gall-bladder. However, in prolapsus visceralis the ligamentum hepato-colicum dextra is the one chiefly affected by elongation. In hepatic hypertrophy of the lobus dextra the ligament may be elongated many folds, in fact, the ligament may be so elongated that it reaches over the brim of the pelvis and suspends the ascending colon almost as low as the pelvic floor. In all cases of considerable elongation due to hypertrophy of the right liver lobe we observed thickening of the ligament from chronic peritonitis in the form of deposits of white connective tissue. If there be a mesenterium commune, one is apt to find in some portion of the free loop of gut that its mesenteries have suffered in localities from old peritonitis, at least I found it to be the case in every subject in which was found a mesenterium commune. In the adult cases of mesenterium commune which came under my observation, it was impossible to learn the exact relations of the great omentum and transverse colon from the distortion and thickening due to peritonitis. However, the relation of the transverse colon and mesogaster appeared to differ little from normal. Another matter I observed in the adult subject of mesenterium commune, and that is the descending colon and the flexura coli lienalis to the sigmoid may be closely adherent, almost exactly similar to the double colon of the horse.

Again, in the examinations of cadavers one frequently observes a peculiar adhesion in the jejunum on the surface of the transverse colon, or mesocolon descendens. The most frequent anomaly of this kind is where the upper end of the jejunum is adherent from one to six inches to the lower surface of the mesocolon transversum. The bowel is adherent in a curved line in its natural loop. A short adhesion of this kind is a frequent occurrence. The adhesions of some of the upper end of the jejunum to the right surface of the mesocolon descendens is a rather rare occurrence so far as I can judge from over 200 autopsies. All these adhesions and peritoneal bands aid in limiting the motion of the navel loop. The ligamentum hepato-colicum is the most significant in curtailing the movement of the navel loop. The next band would be the ligamentum phrenico-colicum dexter, and next would be the adhesions of the upper end of the jejunum to the under surface of the mesocolon transversum, and, lastly, the adhesions found between the jejunum and mesocolon descendens. There is still to be mentioned the relation of the lower end of the ileum to the cæcum. The relation of the lower end of the ileum to the psoas muscle may be entirely altered by the amount of cæcal descent. When the cæcum fails to descend normally, the ileum generally runs upward along the psoas muscle to meet it, and the ileum is apt to have a short mesentery, and thus aid in limiting the movement of the navel loop. The many kinds of individual cases where some peculiar arrest of the development of the peritoneum and bowel have occurred from peritonitis cannot be detailed. The axial rotation of the navel loop could be checked by peritonitis at any stage with its peculiar resultant. All anomalies are generally due to peritonitis. The condition of transposed viscera must be discussed by itself. From the above remarks, it may be observed what an important *rôle* this visceral artery, the arteria mesenterica superior, plays in the development and growth of the navel loop and its mesentery.

The etiology of anomalies of the navel loop may generally be found in inflammation. Is a knowledge of anomalies of the navel loop of any value to the practitioner and surgeon? In mesenterium commune the appendix may be found in almost any locality of the abdominal cavity, and its rupture there would be confusing not only in diagnosis but in operation. Arrest of the cæcum at any point in its travels towards its home in the right iliac fossa may occur from intra-uterine peritonitis, and the rupture of the appendix in the abnormal location would confuse the diagnosis with gall-bladder troubles. An unusual volvulus could arise in mesenterium commune entirely out of the usual site, which is generally (60 per cent.) in the sigmoid flexure.

# CHANCRE OF THE TONGUE, WITH A REPORT OF FOUR CASES.

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CHANCRE of the tongue is a rare lesion, and when it occurs it is almost invariably found upon either border about half an inch from the tip of the organ. At first it is very small, and feels like a small spot under the surface. As it increases in size the lesion becomes elevated and ulcerated by contact with the teeth. It is often covered with glistening false membrane, presenting a peculiar opaline surface, on account of which it is mistaken for a mucous patch. It is, however, always single, has sharply defined and slightly raised and inflamed edges, and is surrounded by circumscribed induration.

Chancre of the tongue may become phagedenic and be transformed into a large ulcer. One such case has been cited by Jullien.[1] The subhyoid ganglia usually are the first to become enlarged, soon followed by enlargement of other cervical and post-cervical glands.

The following statistics of extragenital chancres reported by L. Duncan Bulkley[2] are of interest. In 900 cases of syphilis only about 270 chancres were observed. Of these, twenty-seven, or 10 per cent., were extragenital, only two occurring upon the tongue, or 1.35 per cent. Among 3570 chancres in the male, recorded by Sigmund, Fournier, and Jullien, there were 186 extragenital chancres, or a trifle over 5 per cent. I have been unable to find the record of how many occurred upon the tongue.

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[1] Arthur Van Harlingen, M.D., International Encyclopædia of Surgery.

[2] Transactions of the New York State Medical Society, 1886.

According to Fournier,[1] out of 824 cases of chancre, in only three was the sore found upon the tongue.

An abrasion of the mucous membrane of the organ produced by rough and carious teeth is a frequent predisposing cause of chancre, and accounts for the fact that the lesion is most frequently met with upon one or the other side near the tip. The specific nature of the sore is often unrecognized and mistaken for an innocent ulcer, and the patient not being warned becomes a source of contagion to many innocent people. I believe that if every tongue-chancre was recognized we would find that the percentage of these cases would nearly equal that which is reported for chancre of the lip. It is therefore highly important that the possibility of every case should be borne in mind, and that when a patient presents a sore on the lip, tongue, or tonsil, a guarded diagnosis should be given. And unless an innocent cause is evident, it is our duty to warn him of his danger and that which threatens his family and others, at the same time giving him minute instructions as to hygiene and prophylaxis.

Such a case presented himself to me last July. The history of possible contagion was clear. Three weeks before I saw him he had cohabited with a woman who, as was subsequently ascertained, was being treated for syphilis and at the time had mucous patches on her lips. At the end of two weeks he first noticed that his throat was sore, and when he came to me there was an ulcer on the right tonsil, oval in shape, six-sixteenths of an inch in its longest diameter, having a sharply defined elevated border and covered with an opaline membrane. There was slight enlargement of the submaxillary and anterior cervical glands on the same side. He was married and had several children. I at once warned him of the danger, and for over three months, at great inconvenience, he faithfully followed my directions, procuring for himself separate towels, napkins, and drinking vessels for household use.

I ordered a mouth-wash of peroxide of hydrogen and listerine, and from time to time touched the ulcer with a solution of chromic

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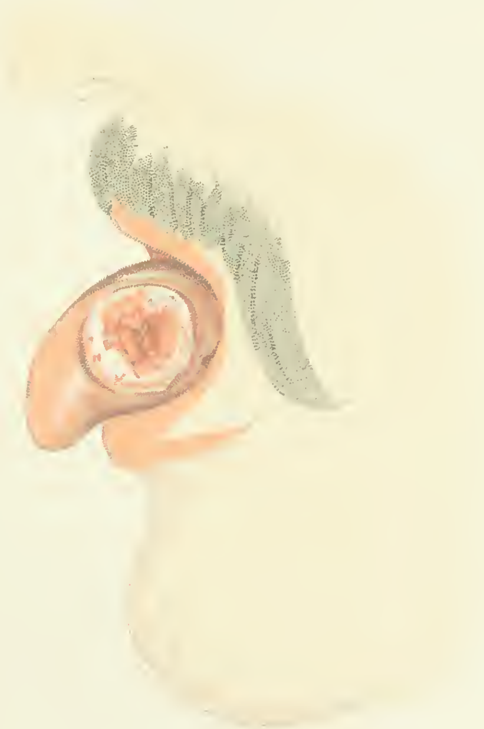
[1] McBurney, Holmes's System of Surgery.



CHANCRE OF THE TONGUE.

acid. At the end of two weeks the ulcer had disappeared, but its seat was elevated and defined. The lymphatic glands were smaller but still enlarged. I saw him again at the end of three months, and as the secondary lesion had not yet appeared he decided to give up taking further precautions. The tonsil was still slightly swollen. I have not heard from him since.

It is possible that the diagnosis of chancre was incorrect, and yet I still believe that this was a primary lesion, one of those rare cases in which the secondary do not manifest themselves, and in which the diagnosis remains to be confirmed by the development of some obscure tertiary lesion.

The following case of tongue chancre is undoubted and is worthy of notice, owing to the typical course it ran and the complications which occurred.

G. S., aged twenty-three years, single, was first seen by me March 17, 1894. On January 22, one day after coition, gonorrhœa developed, and lasted until March 7. On February 21 he noticed a small lump on the left side of tongue one inch from the tip. He described it as feeling like a kernel in the substance of the organ immediately below the surface and slightly elevating it. There was no ulceration until about March 5. There was no pain, but he was annoyed by excessive salivation.

Upon examination I found a chancre situated on the left border of the tongue, one inch from the tip and about the size of a dime. It was round, elevated, and hard. The edges were sharply defined and thickened, and the base indurated. It was entirely covered by a pale, opaline, glistening membrane. In the course of a few days this membrane broke down in the centre, exposing an ulcerated surface as represented in the accompanying sketch, for which I am indebted to Dr. J. Madison Taylor. The subhyoid glands and the anterior cervical glands were beginning to become enlarged on both sides. Salivation was excessive, so that he had to expectorate every few minutes. Deglutition was difficult, and he was excessively nervous and apprehensive. I ordered a mouth wash of boracic acid, and every three days painted the ulcer with a weak solution of chromic acid. The period of incubation in this case was thirty days. The time between the first appearance of the lesion and lymphatic involvement was about twenty-seven days. Twenty-three days later a true syphilitic roseola developed on the back, chest, arms, and legs, which was preceded by an acute eruption on the scalp, back, and chest. At this time, fifty days after it was first noticed, the chancre had disappeared, only a slight depression existing at its seat.

The patient was at once placed upon increasing doses of the protiodide of mercury until he took three and one-third grains daily. By this time the secundæ had entirely disappeared, and as symptoms of salivation began to present, I reduced the dose to one and one-half grains a day. In a very short time all local and constitutional symptoms had left him, and he described himself as feeling perfectly well. He continued treatment until about the middle of July and then gave it up. I saw him again September 14, and found three ulcers on the hard palate, one at the base of the right half arch, partly involving the tongue, and a deep fissure on the dorsum of the tongue, midway between the raphé and left border, about one and a quarter inch in length. These appearances promptly yielded to renewed treatment, so that no evidence of lesion can now be detected. He took one-third of a grain of protiodide of mercury three times a day. This has been reduced to two-thirds of a grain daily, and he appears to be in perfect health.

Nine months after the treatment was started, as he had become quite anæmic, I stopped the protiodide and ordered syr. ferri iodidi, gtt. xx three times a day. He returned to my office ten days later with a small plaque on the dorsum at the seat of the old fissure. A prompt return to the protiodide at once caused this lesion to disappear.

I am indebted to Dr. Orville Horwitz for the notes of the following cases of chancre of tongue occurring in the clinical service of the Jefferson Hospital :

CASE I.—Service of the late Dr. S. W. GROSS.—Samuel F., aged twenty-six years ; single ; laborer. Came to the hospital complaining of a hard, indurated ulcer situated on the left side of the tongue.

He stated that he had had the sore for three weeks ; six weeks previous to coming to the institution he had had intercourse with a prostitute, whom he had kissed repeatedly ; about twenty-eight days later he noticed a small pimple on the tongue, to which at first he paid but little attention. A few days later it became inflamed and ulcerated, and the glands under the jaw on the left side became tender and swollen. Four weeks later this patient developed secondary syphilis.

CASE II.—Service of Dr. HORWITZ.—George K., aged thirty-one years; married; plumber. On examination, a large, indurated, undermined ulcer, the base of which was covered with a plastic lymph, was discovered on the tip of the tongue. Glands on both sides under the jaw were enlarged. He denied having been untrue to his wife; but on further questioning it was found that he was in the habit of smoking the pipes belonging to his fellow-workmen. A diagnosis of chancre was made. Secondary symptoms followed in due course of time.

CASE III.—Service of Dr. HORWITZ.—Harry L., aged thirty-nine years; farmer. Brought to the hospital from Bordentown, N. J. Supposed to be suffering from cancer of the tongue. On examination a large ulcer was discovered on the left side of the organ with swelling of the glands under the jaw on that side. He first noticed the sore six weeks previous to his first visit to the hospital. It first appeared as an ordinary fever blister; the vesicle finally broke, leaving an unhealthy-looking ulcer with a foul base. The patient stated that two weeks before the chancre appeared he had spent an evening at a house of ill-fame in Philadelphia, and whilst he had not indulged in sexual intercourse with any of the inmates he had kissed them repeatedly.

Later the initial lesion was followed by the usual secondary manifestations.

# STATISTICAL REPORT OF SEVEN HUNDRED AND THREE MAJOR AMPUTATIONS, FROM THE RECORDS OF EIGHT HOSPITALS OF NEW YORK CITY.[1]

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THE following statistics have been taken from the records of Bellevue, New York, Roosevelt, St. Luke's, Mt. Sinai, Chambers Street (now the Hudson Street), House of Relief, German, and Presbyterian hospitals in the City of New York, and include all recorded cases of single amputations in the above institutions from January, 1884, to January, 1894, having been performed by various surgeons.

| | Amputations. | Deaths. | Per Cent. |
|---|---|---|---|
| Wrist | 7 | 0 | 0 |
| Forearm | 71 | 1 | 1.4 |
| Elbow | 6 | 0 | 0 |
| Arm | 88 | 16 | 18 |
| Shoulder | 24 | 6 | 25 |
| Foot | 64 | 5 | 7.8 |
| Leg | 156 | 19 | 12 |
| Knee | 46 | 6 | 13 |
| Thigh | 223 | 48 | 21.5 |
| Hip | 18 | 8 | 44.4 |
| Total | 703 | 109 | 15.5 |

During the period of ten years there were 703 single amputations recorded with 109 deaths, giving a mortality-rate of 15.5 per cent., divided among the various extremities as shown in the foregoing table.

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[1] Read before the Academy of Medicine, under the auspices of the Section on Surgery, February 21, 1895.

The causes of death were divided into two general classes:

Class A or general shock—*i.e.*, shock from the injury—included all cases of sepsis and constitutional diseases previous to the operation.

Class B or operative shock—*i.e.*, shock following the operation—included all cases of death from complications following operations.

In Class A we have thirty deaths, or 29 per cent., due to general shock from the injury; twenty-one deaths, or 20 per cent., due to septicæmia previous to operation; these cases were those in which conservatism was unsuccessfully practised or the consent of the patient withheld until the septic process was well advanced; eighteen deaths, or 17 per cent., were due to constitutional causes; these were cases of malignant and tubercular disease with marked undermining of the physical condition of the patient; these deaths sum up a total of 66 per cent. of all deaths for this class.

In Class B we have twenty-seven deaths, or 26 per cent., due to shock following the operation; one death, or 1 per cent., due to secondary hæmorrhage; three deaths, or 3 per cent., due to sepsis; three deaths, or 3 per cent., due to complicating nephritis and pneumonia, and one death, or 1 per cent., due to bichloride of mercury-poisoning. This death was, in all probability, due to operation shock.

Twenty-one and four-tenths per cent. of all deaths were of the freshly traumatic variety, while eleven and seven-tenths per cent. were of the non-traumatic variety, including under this heading the old traumatics that required amputation.

As the death-rate of Bellevue hospital was 16 per cent. and the average of all the institutions was 15.5 per cent., I made a collection of the cases in Bellevue for the ten years with a view to comparing the results in the more perfected antiseptic and aseptic half of this period, with the following results:

| | Freshly Traumatic Cases. | Average Age. | Deaths. | Average Age at Death. | Per Cent. |
|---|---|---|---|---|---|
| 1884 to 1889 . . . . | 47 | 34 | 12 | 43 | 25.5 |
| 1889 to 1894 . . . . . | 20 | 35 | 4 | 58 | 20.00 |

Comparing the records of the five years from 1884 to 1889 with those of 1889 to 1894 we note a diminution in the mortality-rate of 5.5 per cent. in the latter half, although the average age of the cases amputated had increased one year and the average age in the cases that died had increased fifteen years.

Taking all the single amputations in Bellevue during this period we have the following:

| | Cases. | Deaths. | Per Cent. |
|---|---|---|---|
| 1884 to 1889 . . . . . . . . . . . . . . . . | 114 | 19 | 16 |
| 1889 to 1894 . . . . . . . . . . . . . . . . | 61 | 9 | 14 |

Here we note a diminution of 2 per cent. in the mortality-rate in all amputations during the second half as compared to the rate in the first half, or the less perfect antiseptic period.

Out of 175 cases in Bellevue there were 108 amputations for old traumatism and disease, with a mortality of 12, or a rate of 11.1 per cent. Comparing the mortality-rate of these hospitals with the rates of others we find the following:

Dent and Bull[1] report 400 cases from 1874 to 1888, a period of fourteen years, with a mortality of 21 per cent.

Schede[2] reports 377 cases, previous to 1882, with a mortality-rate of 29.18 per cent., of these 3 per cent. were due to secondary hæmorrhages as compared to 1 per cent. in our records.

The above high rates of mortality can be accounted for largely by the fact that the operations were performed before and in the very early days of antisepsis.

Frederick Page,[3] in the reports of the Royal Infirmary of Newcastle-on-Tyne, presents the following statistics of single amputations only:

From 1883 to 1891, 200 traumatic cases, with a mortality-rate of 10 per cent. Three hundred and twenty for disease, with a mortality-rate of 4.6 per cent.

In 1891 he reports seventy-nine cases of individual amputations with a mortality of 8.8 per cent.

Gerster[4] reports statistics of 1000 unselected hospital cases, with a mortality of about 15 per cent., being practically the same rate as that of the hospitals furnishing our statistics.

He also reports forty-three cases of individual amputations, with a mortality-rate of 11.6 per cent.

Finally, Dr. W. L. Estes,[5] of Pennsylvania, reports 294 single amputations, with a mortality-rate of but 4.6 per cent.

This mortality being so much lower than any others, I wrote Dr. Estes for the average age of his patients, and received word that, as near as he could remember, it was twenty-five years.

This average age and the physical condition of railroad men without question will account in part for this excellent rate; but another factor is to be found in his article, page 549, as follows:

"In the list of single amputations I have not included amputations done for purely euthanastic purposes, in cases of evulsion complicated with other serious injuries, when the patients arrived at the hospital in moribund and utterly hopeless conditions."

In summarizing, it must be conceded from the foregoing statistics,—

That the mortality of single operators is lower than in general hospitals.

That, owing to ignorance of the classes that inhabit our large charity institutions, consent is not easily obtained, in a great number of cases, until an almost fatal condition is present, and as a result of this condition the mortality-rate is materially increased.

That the mortality-rate in the last few years, owing to improved antiseptic and aseptic technique, has been lowered considerably.

That deaths from secondary hæmorrhage have diminished in direct proportion to the perfection of our antisepsis and asepsis.

That age, although a factor in the mortality-rate, does not carry with it at present the great importance of former years.

And, finally, that the prognosis as to recovery from the operation in amputations for disease is much better than in cases of trauma.

### REFERENCES.

[1] *Dent and Bull:* Lancet, 1890, p. 303.
[2] *Schede:* Pitha and Billroth, Vol. II, 2, p. 239.
[3] *Frederick Page:* Lancet, 1892, p. 523.
[4] *Gerster:* Antiseptic Surgery, 1890, p. 60.
[5] *W. L. Estes:* New York Medical Record, November 3, 1894.

# A SUCCESSFUL CASE OF TRANSPERITONEAL URETERO-LITHOTOMY.[1]

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REMOVAL of renal calculi impacted in the ureter by the transperitoneal, subperitoneal, or lumbar route is perhaps sufficiently uncommon to warrant publication of such cases. I believe that only three or four instances of transperitoneal removal have been recorded.

A woman, aged fifty-seven years, was admitted to the Woman's Hospital of Philadelphia in December, 1894, with history of attacks of renal colic from the time she was eleven years old. At first the attacks occurred, according to her statement, about every week. Subsequently they became less frequent, occurring not oftener than once in two or three months. Seventeen years ago she noticed that the urine after these attacks of pain contained a reddish sediment. She, on a number of occasions, passed small stones, which were about the size of a flaxseed. Recently she had had weekly attacks of pain, and the urine passed the day following had contained large quantities of pus. The pain was felt in the left side over the region of the kidney, where tenderness on pressure existed. During the paroxysms, the pain radiated downward and forward towards the bladder. An examination of the urine after admission showed that she passed forty-eight ounces in twenty-four hours. The urine was of an acid reaction, had a specific gravity of 1010, and contained some albumen, but no sugar. It contained urea 1 per cent., pus 3 per cent.

Attacks of severe renal colic occurred every two or three days, and gave so much pain that my colleague, Dr. Anna M. Fullerton, dilated the urethra and catheterized the ureters by touch. From the right ureter an ounce and a half of clear urine was drawn. The left ureter admitted the catheter for about an inch and a half, when an obstruction was met. No fluid was obtained from this ureter. The urine obtained from the right ureter showed neither pus nor casts. A specimen taken from the bladder itself contained a few pus-cells.

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[1] Read by title before the American Surgical Association, May 28, 1895.

About a week later I explored the kidney and ureter by lumbar incision. The kidney was very small and was thoroughly examined with my finger passed over both its anterior and posterior surfaces. I could feel no stone in the kidney proper, nor in the pelvis. The organ was only about four inches long and had a normal appearance and feel. The ureter was exposed about one inch below the pelvis of the kidney, and was found to be greatly enlarged. It was about as wide as my forefinger and had thick walls. I made a small longitudinal opening in it and passed a rubber bougie downward for about ten inches. The bougie then met an obstruction. The finger introduced into the vagina readily felt the end of the bougie about two inches above the bladder.

The urethra was then dilated; and my finger introduced into the bladder detected the bougie within the ureter. Vaginal touch then discovered what seemed to be a small growth high up in the pelvis behind the uterus and to its left. This had never been discovered during the vaginal examinations made before operation. Dr. Fullerton then passed by touch a ureteral catheter from the bladder. The two instruments came within about half an inch of each other, but they could not be brought into contact, though the finger in the vagina could feel both instruments.

This examination led me to believe that there was a small tumor pressing upon the ureter and causing a valve-like stricture, which at times permitted the dammed up pus and urine to escape. I believed that the tumor was rather small, since it was only discovered by vaginal examination after it had been pressed downward by the bougie introduced into the ureter by the lumbar incision. The mass seemed to be about the size of an English walnut. I concluded that abdominal section would subsequently be required, and therefore closed the ureteral wound with four silk sutures applied in the manner of Lembert. A small drainage-tube was placed in the posterior end of the oblique lumbar wound. The urethra, which had been lacerated by the dilatation, was repaired by sutures introduced by Dr. Fullerton.

The wounds healed promptly. The pain which the patient had suffered became less, and was felt much lower down in the abdomen than previously. She was discharged with directions to return at a later period for laparotomy to remove the small tumor which was supposed to be pressing upon the ureter.

She was readmitted on April 18. A mass was still felt in the left broad ligament, close to the pelvic wall. The uterus was movable and in good position. The daily amount of urine was forty-four ounces. It was on one occasion acid, without albumen; and on another neutral, with albumen and pus present.

On April 26, 1895, an incision in the median line of the abdomen was made and the pelvis explored. A thickening was felt in the left broad ligament close to the pelvic wall, but no tumor was found pressing upon the ureter as I had expected. The left ovary was small, sclerosed, and movable. I determined, therefore, to cut down upon the ureter to see whether there was any stricture from tumor in the wall, or other inflammatory exudate occluding its calibre. I cut through the peritoneum, lifted up the ureter, and made a small opening in it, protecting the surrounding parts as much as possible from any urine that might escape. The lumen seemed free from urine, and a steel uterine sound, used as a probe, was readily passed downward into the bladder. Its presence here was proved by contact with a urethral sound introduced into the bladder. I then used the same instrument to explore the ureter upward, and almost immediately came in contact with a hard substance, which on impact gave the characteristic click of stone.

By pressure upon the ureter, beginning above the stone, I caused it to be extruded through the opening already made. The stone was the shape of a large olive pit, and measured seven-eighths of an inch in length, and about half an inch in its broadest part. The opening in the ureter was closed with silk sutures; the peritoneum over the ureter brought together with continuous catgut sutures. A split in the broad ligament was stitched with catgut. The abdominal cavity was kept uncontaminated during these manipulations, and could have been closed with propriety without drainage as the peritoneum was not soiled. A drainage-tube, however, was put in because of the possibility of the sutures not holding, though I really had no doubt of their being able to keep the ureteral wound closed.

The patient at the present time, which is a month after operation, has had no recurrence of pain, and has made an uneventful recovery. The urine about ten days ago showed a little pus.

The facility with which the operation was done and the rapid recovery demonstrate how satisfactorily removal of stone from the ureter can be thus accomplished. It is evident that the stone was not very tightly fastened within the ureter, though it is probable that it did not move during the ordinary occupations of the patient. After it had been pushed down by the rubber bougie introduced at the lumbar incision, the pain was felt at a lower region than previously. This would seem to indicate that the calculus occupied pretty much the same position all the time until displaced by the bougie which I introduced through the wound. It was the bulging produced by the stone thrust into the lower part of the ureter which gave the impression of a small tumor which we felt through the vaginal wall. This was not observed in previous vaginal examinations, because the stone was then situated at a higher point.

# A CASE OF HEPATO-NEPHRO-LITHOTOMY.

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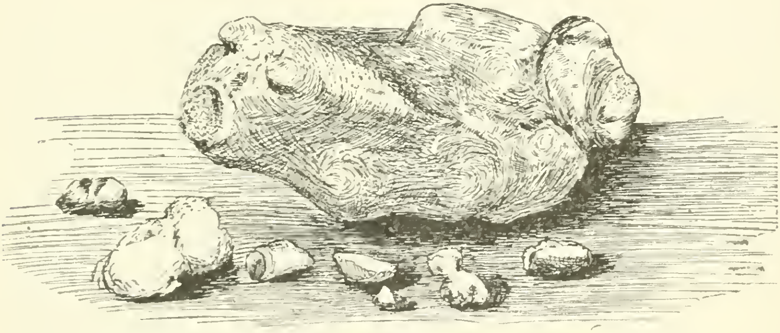
A RECENT case coming under my observation is so unique in many of its features that it would seem to deserve full report.

A man, now aged forty-six years, came under my notice about seven years ago suffering with deep and, for a time, surgically impermeable traumatic stricture. It was some weeks before I succeeded in passing a filiform into the bladder on account of the tortuous formation of the stricture. The patient could evacuate the bladder fairly well after prolonged straining. Aside from the stricture, the patient had always been a healthy man. His habits were temperate. His family history was excellent. There was no history of gout, rheumatism, or other constitutional disease in the family. After some weeks of careful treatment, I succeeded in dilating the stricture up to a calibre of No. 30 French. The patient has, since his first course of treatment, visited me occasionally for the purpose of having the sound passed. There was a moderate amount of cystitis, as might be expected, secondary to the stricture. The urine did not clear up perfectly after the successful treatment of the stricture, but remained quite cloudy. Exacerbations of cystitis occurred from time to time, necessitating irrigation and the usual general and local treatment for cystitis. The cystitis was finally apparently under control when, without increase in the symptoms referable to the bladder, the urine began to show a marked deposit of pus. This increased, there being no constitutional symptoms incidental to the suppuration. Careful examination showed the origin of the pus to be in the pelves of the kidneys. The pus gradually increased until the urine contained the largest quantity that I have ever seen, aside from certain exceptional cases of evacuation of an abscess into the cavity of the bladder. There were no casts, the urinary deposit consisting of pure pus admixed with a small amount of epithelium from the bladder and the renal pelvis. This profuse discharge of pus continued for some months without having any special deleterious effect upon the patient's health. Suddenly, however, he began to have a moderate amount of fever, loss of appetite, emaciation, night-sweats, and diarrhœa. Within a week he became extremely debilitated, but not sufficiently so to necessitate his going to bed. There was no clear indication for surgical interference; hence the sole reliance was internal medication, the usual urinary antiseptics, tonics, and stimulants being given. After this condition had lasted for several weeks without any material improvement, Clark's solutions of iodine and chloride of gold were administered hypodermically with most excellent results, the patient soon regaining his usual condition of health and the pus in the urine being reduced to a minimum. From the beginning of his urethral trouble there had never been the slightest complaint of pain in the back, or symptoms referable to the kidney or ureter. Never during his life had the patient been affected by anything which might be termed renal colic. There was at no time, nor has there ever been, excepting after the operation upon the kidney, which will shortly be described, the slightest trace of blood in the urine. The patient remained in a condition of health quite satisfactory to himself until the onset of the difficulty for which the operation under consideration was performed. The urine remained quite cloudy, and contained, at all times, a moderate amount of muco-pus. About November 20, 1894, while I was away from the city, the patient was suddenly taken ill, with recurrent chills and fever, vomiting, loss of appetite, and night-sweats. On my return to the city, five days later, I found that, for the first time since he came under my care, the patient had been compelled to take to his bed. He came to my office, however, and remained an ambulant patient until operated upon. There was still no pain or tenderness in the vicinity of the kidneys, and it was difficult to convince the patient that even a suspicion of a collection of pus in one or the other loin was warrantable. After careful study of the case for about a week, I became convinced that there was some suppuration in the vicinity of the right kidney, and, as the liver was considerably enlarged, I suspected a complicating hepatic abscess, this suspicion being otherwise justified by slight jaundice. The tongue was heavily coated; temperature ranged from 102° F. in the morning to 103° F. in the evening. The patient emaciated quite rapidly. A few days after informing the patient of the probability of localized suppuration, Professor William E. Quine saw the case with me in consultation and verified my suspicions of a circumscribed collection of pus in the vicinity of the right kidney, and also the possibility of a complicating hepatic abscess. As there was no definite tumor in the flank and no well outlined local symptoms, I was not perfectly clear as to the condition present for nearly a week later, when I succeeded in striking pus anteriorly just below the free border of the ribs a fter repeated attempts by means of the aspirator. An operation was decided upon, and I determined to open anteriorly with the view of operating upon the hepatic abscess which I believed to be present, leaving the abscess in the region of the kidney for future consideration.

*Operation.*—An incision was made in the abdominal wall just beyond the outer border of the rectus muscle, extending from the free margin of the ribs to the crest of the ilium. On cutting through the fascia transversalis, I found the peritoneum adherent to a coil of intestine, which in turn was adherent to the anterior surface of the greatly-enlarged liver. Only cautious dissection prevented injury to the bowel. Repeated attempts at aspiration were necessary before I finally encountered pus, the needle being passed obliquely backward and inward in the direction of the spine. Pus was found at much greater depth than I had anticipated from the results of the aspiration performed before the abdomen was opened. The needle was left in position and an incision made in the thickened visceral and parietal peritoneum, which were closely fused together over the surface of the liver. On turning down the inferior edge of the incised peritoneum, it was found to be firmly adherent to the liver and to the coil of intestine already alluded to, the general peritoneal cavity thus being effectually walled off. The Paquelin was now made to follow the needle and the pus cavity was finally entered, this being a rather difficult matter, because of the small area of the operation field. On entering the abscess cavity in the liver four ounces of creamy pus escaped. On exploring the cavity with the finger, I found that it extended backward and in such a manner that its long axis was directed towards the region of the kidney. Thinking that I detected fluctuation in the posterior wall of the abscess, I deliberately pushed my finger through the thin wall and opened into a second abscess evidently perinephritic in character. On opening the perinephritic abscess a large quantity of pus escaped, and with it a small amount of sabulous material, which caused me immediately to suspect the presence of stone. By dint of great exertion I was enabled to pass the finger to the pelvis of the kidney, which I found enormously dilated and presenting an opening towards the perinephritic abscess cavity. The region of the pelvis of the kidney was no sooner touched than a hard body was felt, and on passing the finger through the encapsulating wall of the renal pelvis a calculus was distinctly outlined. Thinking that the calculus was not of large dimensions, because of the small size of the presenting part reached by the finger, I attempted to extract it with a pair of forceps, and the presenting point breaking off I extracted a calculous mass which, as shown by its facets, was evidently a secondary calculus fused upon one of larger size. Several particles of calculous material now escaped from the pelvis of the kidney into the abscess cavity, and were removed with the finger. I decided to remove the larger calculous mass entire, if possible, and, finally, by the aid of a pair of long-curved pedicle forceps and a lithotomy scoop, I succeeded in extracting the remainder of the calculus entire. The wound was deeply tamponned with iodoform gauze for drainage, the gauze in a few days being substituted by rubber tubing, the latter being entirely removed at the end of four weeks.



Renal calculus removed in Lydston's case of hepato-nephro-lithotomy.

The illustration above shows the calculus and its natural size. The entire calculous mass weighed 746 grains. As will be observed, it is ovoid in form, and tuberculated. It is evidently composed of a number of calculi fused together by phosphatic laminæ.

The subsequent history of the case was uneventful. At the present writing, three months after the operation, the wound is almost closed, there being but a small amount of pus and no urine escaping from the resulting fistula. The patient has gained rapidly in weight and strength ; the urine is vastly improved in appearance, and it is evident that the patient's life has been greatly prolonged by the operation. The liver is still considerably enlarged, and, notwithstanding the fact that the temperature is now normal, I am suspicious that there may be further collections of pus in that organ. That there is a certain degree of pyelitis in the left kidney, I am satisfied, and whether it may become necessary to remove the degenerated remains of the right kidney is questionable. If the patient were otherwise in excellent condition, and the urine should remain purulent, a nephrectomy would certainly be indicated, but under the existing circumstances of this case it is questionable whether further operative interference will be warrantable unless definite abscesses should form in some situation.

I submit the case as exceptional,—

(1) Because of the large size of the calculus.

(2) The entire absence of all symptoms referable to renal calculus, notwithstanding the fact that the patient was most carefully observed for some years.

(3) The difficulty of diagnosis incidental to pyelitis from ascending infection secondary to a condition entirely independent of the renal calculus.

(4) The extraordinary method of operation necessitated by the exigencies of the case.

# A CASE OF VARICOSE ANEURISM (SACCULATED ARTERIO-VENOUS FISTULE) OF THE THIGH TREATED BY TRANSPERITONEAL LIGATION OF THE EXTERNAL ILIAC ARTERY, WITH REMARKS ON THE NOMENCLATURE OF VASCULAR LESIONS CHARACTERIZED BY PULSATION.[1]

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A NEGRO, twenty-six years of age, was shot in October, 1887, with a pistol of forty-four calibre. The ball entered the right thigh on its inner aspect near the apex of Scarpa's triangle, and passing through the limb made its exit at a point on the outer side at about the same level as the wound of entrance. The course of the missile was posterior to the femur. He bled very freely from the wound, and after it healed experienced no inconvenience except a throbbing at the seat of injury.

In December, 1892, the patient, who had paid no particular attention to the condition of the thigh, applied to Dr. George W. Heinitsch, of Spartanburg, S. C., for a large ulcer situated on the front of the right leg. Dr. Heinitsch found the right leg and thigh much swollen and the superficial veins greatly enlarged. Violent pulsation existed in the thigh and in the superficial veins. I saw the patient in December, 1893. The right leg and thigh were greatly enlarged, being about three times the bulk of the normal leg on the other side. The superficial veins of the leg, thigh, and pubes were greatly hypertrophied and tortuous. A very distinct impulse was felt over the

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[1] Read before the Section on General Surgery of the College of Physicians of Philadelphia, March 8, 1895.

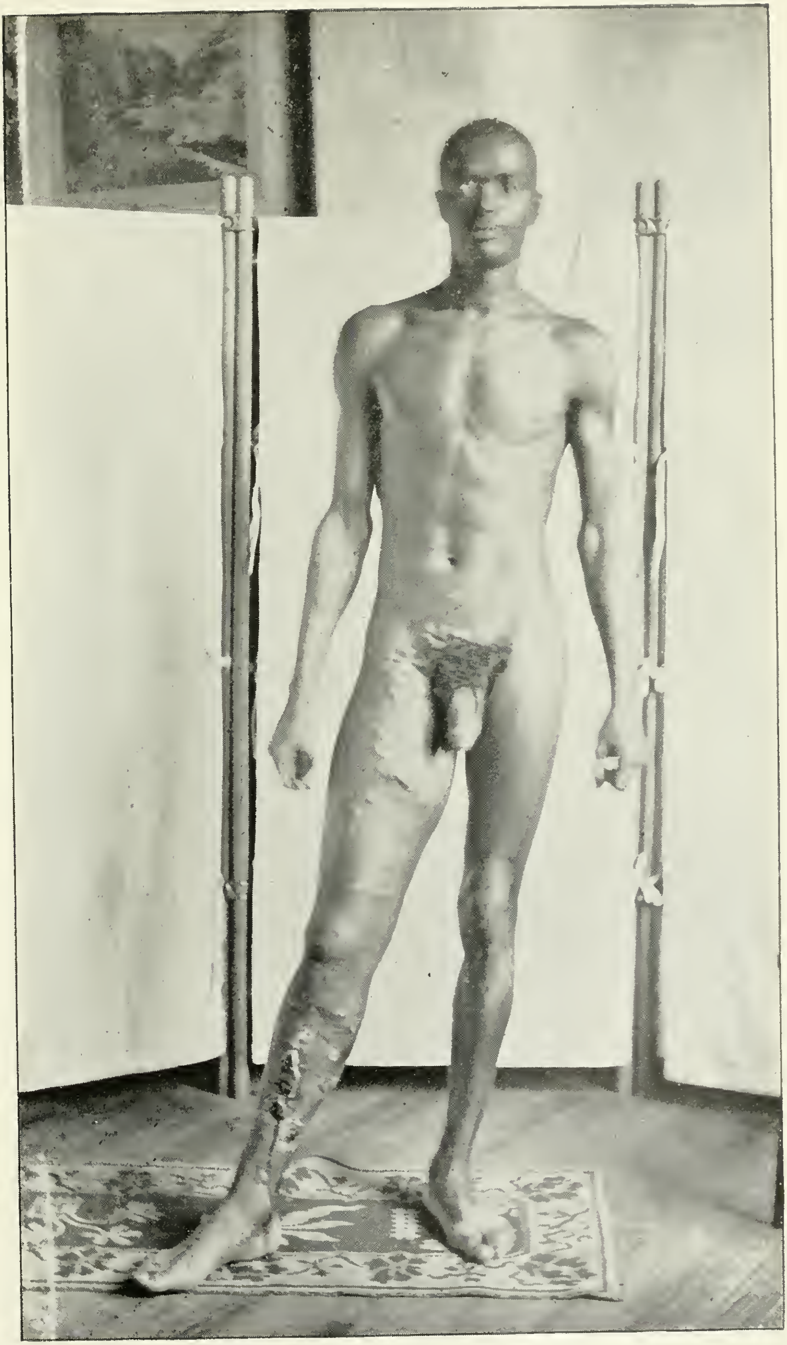

FIG. 1.—Sacculated arterio-venous fistule.

thigh and in the region of Poupart's ligament. Its greatest intensity was at the situation of the scar on the inner side of the thigh. A purring murmur was heard on auscultation, and was most distinct over the course of the femoral vessels about two and a half inches higher than the scar. The murmur was heard also at the seat of the wound of exit, though no impulse was felt in this region. Murmur and pulsation were both distinct in the popliteal space. Pressure on the right external iliac artery caused cessation of pulsation and murmur. The patient had become disabled by the weight and discomfort produced by the swollen limb and the ulcer.

The case was evidently one of arterio-venous fistule produced by a simultaneous wound of the artery and vein. It was impossible to determine that there was a sac between the artery and vein, or that the communication between the two blood-vessels was a direct one.

I called a consultation of my colleagues at the Polyclinic Hospital in order to aid me in deciding what was to be done for the relief of the condition, which was evidently exceedingly serious. The question of cutting down upon the vessels at the seat of the wound of entrance for the purpose of obliterating the orifice of communication was discussed. The probability of gangrene occurring as a result of ligation of the main trunk was also considered, as was the propriety of amputation. The last was discarded because it would have required an amputation close to the hip-joint.

I finally, though with considerable hesitation and with a good deal of doubt as to the outcome, concluded to ligate the external iliac artery by means of incision in the anterior abdominal wall and division of the peritoneum lying in front of the vessel. I arrived at this conclusion because of the impossibility of determining the extent of involvement of the vessels, and because it seemed to me that the arterio-venous communication was situated high up in the thigh, in the neighborhood of Scarpa's triangle. I accordingly ligated the external iliac artery with a silk ligature, reaching the vessel by the transperitoneal method. I closed the sheath of the vessel with catgut. The limb, in which pulsation immediately ceased, was wrapped in absorbent cotton, surrounded by hot-water bottles, and kept somewhat elevated.

The operation was done on January 6, 1894. Gangrene occurred, and the patient died on the sixth day. The propriety of amputation was again carefully considered after the gangrenous process had begun, but was deemed unadvisable. After I came to this conclusion, I put the narrow Esmarch bandage or tourniquet tightly around the thigh at the upper limit of the gangrenous area, with the hope that this constriction might diminish the amount of absorption of septic matter from the tissues, which were becoming devitalized. Incisions were also made in the devitalized region to allow the gases of decomposition to escape.

Post-mortem examination showed that the common iliac and external iliac arteries on the affected side were nearly twice as large as those on the sound side of the body. The femoral artery also was much hypertrophied. A dissection of the specimen, which includes the artery at the point of ligation, shows the arterio-venous communication to have been in Hunter's canal, a considerable distance below the wound of entrance. This surprised me very much. It makes evident the fact that an incision of ordinary length over the point where the bullet entered would not have enabled me to reach the seat of disease, if I had adopted the mode of treatment which is probably best in this form of disease,—namely, to cut down upon the communication and tie the artery on both sides of the orifice.

When the autopsy was made, it at first seemed exceedingly doubtful whether the diagnosis was correct, because the artery and vein in the neighborhood of the injury did not show any communication. Dissection made afterwards revealed that there was a direct communication down near the knee between the hypertrophied femoral vein and the femoral artery, with a small sac connected with the artery, as well as one connected with the vein. The opening between the artery and vein occurred at a point where their walls were close together.

The orifice of communication between the two vessels is like that in aneurismal varix, or simple arterio-venous fistule, but there is a sac connected with each vessel instead of a single sac between the vessels, as is usually found in the disease called varicose aneurism.

A careful examination made after the specimen has been shrunken by a year's preservation in alcohol, shows the artery and vein just above the orifice of communication to be of about the same size, but the wall of the vein is about twice as thick as that of the artery. Each vessel in its collapsed state measures about a half inch in width. The valves of the veins are proportionately hypertrophied.

Below the orifice of communication the vein is of practically the same size as it is above, but the artery is only about one-half as large as above. The walls of the two vessels have about an equal thickness. The vein below the opening is filled with clot, the artery at the same place is occupied by a small loose clot. The vessels are now free from clot above. Their original condition is not known. When the specimen was obtained, gangrene had invaded the region in which the lesion was situated, but the vessels had not been destroyed.

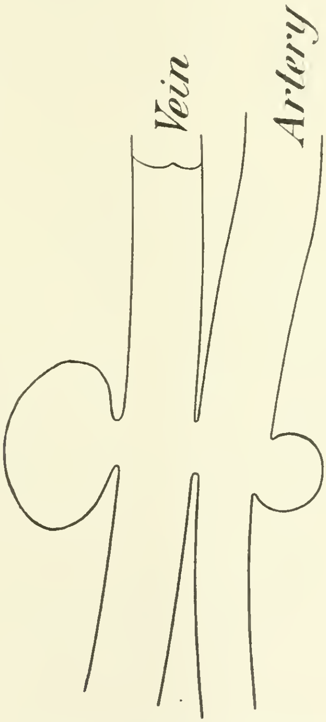

FIG. 2.—Diagram of Roberts's case of sacculated arterio-venous fistule.

The fistule between the artery and vein is a circular opening about three-eighths of an inch in diameter, with smooth edges. The walls of the two vessels above and below, as well as at the opening, are in close contact, and there is no sac between the artery and vein.

In the side of the vein opposite the fistule is another opening nearly as large as the fistule. This is the entrance to a sac, with walls rather thinner than those of the vein, which is lined with a serous membrane resembling the internal coat of the vein. The sac is oval in shape and has a neck where it opens into the calibre of the vein. Its long diameter measures about an inch, and corresponds with the axis of the vein. Its short diameter is about a half inch. In the side of the artery, opposite to the fistulous communication with the vein, there is an opening leading to small dilatation of the arterial wall, which is about a half inch in diameter and is nearly spherical. This sac has not a neck where it joins the vessel, but is located like a sessile growth would be.

The report of this case impels me to say a few words on the confusion which has been produced by the inaccurate employment of the word "aneurism," in the hope that surgeons may be induced to limit the term to one definite condition. I have elsewhere[1] defined an aneurism as a "circumscribed dilatation of one or more of the arterial coats induced by the distending influence of the blood-current upon abnormal vascular walls." This definition includes true spontaneous aneurism and true traumatic aneurism. It intentionally excludes a number of pathological conditions to which has long been applied the term "aneurism," with the addition of adjectives or other descriptive words.

My definition excludes,—

(1) General dilatation with elongation of an artery (called varicose artery or arterial varix, but also called cirsoid *aneurism*).

(2) General dilatation of small arteries and of capillaries (called arterial angeioma, also called *aneurism* by anastomosis).

(3) Arterio-venous communications or fistules (called aneurismal varix, varicose aneurism, and arterio-venous *aneurism*).

(4) Separation of the arterial tunics by the blood-current (usually called dissecting *aneurism*).

(5) Extravasation of arterial blood due to spontaneous rupture (one of the forms of so-called false *aneurism*).

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[1] Manual of Modern Surgery.

(6) Extravasation of arterial blood due to wounds and injuries (called, by some writers, a form of traumatic *aneurism*).

These widely different pathological conditions often receive, though I think improperly, the name " aneurism," because they are tumors containing blood or blood clots. They present symptoms and require treatment different from true aneurism. Therefore the term " aneurism" in describing them is inaccurate and confusing to student and practitioner.

A more strict application of the name aneurism has long seemed to me desirable, and I have for a number of years adopted the definition given above.

The term " traumatic aneurism," to properly come under the definition which I have offered, must be restricted to three conditions,—

(1) Dilatation of the cicatricial tissue and adjacent arterial wall after a healed penetrating wound of an artery.

(2) Dilatation and hernial protrusion of the uninjured inner coats through a wound of the outer tunic alone.

(3) Dilatation of the outer tunic after an injury producing rupture of the inner coats alone.

The ruptures referred to in the third class are, as a rule, produced only in vessels whose inner coats have been weakened by degenerative changes.

I admit that a limited extravasation of blood from puncture of one of the smaller arteries may become surrounded by an adventitious sac, formed by inflammatory condensation and thickening of the normal areolar tissue. This is sometimes called a " traumatic aneurism," but is really an encysted extravasation of blood or an arterial hæmatoma. A diffuse and burrowing arterial extravasation has even less right to be called an aneurism.

To call either of these conditions a " false aneurism," as is sometimes done, is equally illogical. An aneurism which has to be designated as " false" is certainly not an aneurism.

I would apply the term " arterio-venous fistule" to arterio-venous communications, whether traumatic or spontaneous. The variety in which there is a direct communication, without any sac being formed in connection with the vessels, and which is usually called "aneurismal varix," I would term "simple arterio-venous fistule." The variety which shows the development of a sac between the artery and vein, or in connection with either or both vessels, I would call "sacculated arterio-venous fistule," instead of using the term varicose aneurism.

# A CASE OF MULTIPLE GUNSHOT WOUNDS OF THE INTESTINE; RESECTION OF FORTY-THREE INCHES OF ILEUM; ANASTOMOSIS WITH MURPHY BUTTON; RECOVERY.

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OF PORTLAND, ORE.,

DIVISION SURGEON, SOUTHERN PACIFIC COMPANY; ATTENDING SURGEON, GOOD SAMARITAN HOSPITAL.

WITH the kind permission of Dr. C. H. Wheeler, city physician, I take pleasure in reporting the following case as illustrating several points of special interest, among which are the great vitality manifested by certain individuals after severe injuries, the great benefits due to the observance of cleanliness in the treatment of wounds generally, and the wonderful help to patient and surgeon through the use of the Murphy button.

D. M., a healthy Italian laborer, aged thirty-nine years, after attempting to kill a countryman, shot himself with a 38-calibre pistol, about 7 P.M., February 6, 1895. Dr. Wheeler was summoned, and had the patient removed to the Good Samaritan Hospital. Examination revealed a wound in the middle line about one and a half inches below the umbilicus, through which a probe was readily passed into the abdominal cavity. There was but little shock, and there being no other symptoms present to contra-indicate an exploration of the track of the ball, with the view of finding out and repairing whatever injury had been produced, a laparotomy was immediately performed.

Considerable blood welled up from the cavity as soon as the peritoneum was freely incised, but as it was readily wiped away, the injury of any large or important vessel was precluded.

A careful but rapid manipulation of the intestines very soon revealed a wound of the ileum, showing the characteristic eversion of its mucous lining and escape of contents.

Dr. Wheeler repaired the wound at once with Lembert sutures, two rows, intending to treat any others in the same manner if found.

Further search not only revealed eight other openings at a considerable distance from this one, but a condition of affairs which imperatively demanded a resection of the bowel at two places. At one point there were three openings in such close proximity and involving the integrity of the wall to such an extent as to preclude the possibility of repair by sutures without interfering seriously with the lumen of the gut.

At another place, some little distance removed, the bullet had passed through the mesenteric border of the intestine, making a large opening, thereby interrupting the blood-supply, so that a slough would surely have resulted. On this account a single resection, embracing all the wounds, was decided upon, and Dr. Wheeler kindly asked me to proceed with the work.

I decided to attempt a lateral anastomosis with a four-inch incision, after the method recommended by Dr. Abbe, as we had been unable to secure a Murphy button.

Before completing the preliminary steps of the operation, however, Dr. A. C. Smith arrived and kindly supplied a button, the largest size, and aided materially by suggestion and otherwise in completing the work.

After cleansing the injured portion of the gut and applying tapes on both sides to prevent any further escape of its contents, a straight line of catgut sutures was passed through the mesentery, which was then incised and the entire damaged portion removed. The mesentery was cut too close to the line of sutures, allowing a retraction of the openings of some of the vessels, which resulted in a large hæmatoma in its loose folds.

Further leakage, however, was prevented by a continuous suture, passed in such a way as to fold the mesentery on itself and at the same time close the large gap.

In the application of the female portion of the button too little tissue was included in the purse-string, permitting a tearing out and retraction of the mucous and muscular layers, so that at one point the button was held in place by the peritoneum alone. After completing the anastomosis, a further search failed to reveal the presence of other wounds in the intestine or the presence of the bullet in the abdominal cavity; nor could any opening be discovered in the posterior wall of the cavity, though it seems certain such must have existed, as the bullet did not appear in the stools, nor was it found in the damaged intestine. Searching for a missile in the intestine seems, on the face of the assertion, unusual, yet there are two cases in my own experience where, after penetrating wounds of the abdominal cavity, the bullet has been passed per rectum, and both, strange to say, resulted in a recovery without operation. The condition of the patient was very satisfactory after the completion of the intestinal work, so the entire cavity was well flushed with sterilized water; and before applying the sutures to the external wound the soiled edges along the track of the bullet were partially dissected out. The portion of the intestine removed measured, without stretching, just forty-three inches.

The subsequent course of the case was almost uninterrupted. He recovered speedily from the shock, which at no time was pronounced, and made but little complaint.

There was but slight nausea and vomiting and comparatively little pain at any time, except in the abdominal wound, which suppurated.

The temperature was 102° F. and the pulse 108 on the morning following the operation, but were never again as high, although generally above normal on account of the condition of the abdominal wound.

The after-treatment was that ordinarily employed in a laparotomy, liquid food being alone allowed until the passage of the button, *on the ninth day*, though the patient, I am since told, ate a piece of bread on the fifth day without any harm. Soft food was given after the button came away, and a full diet of meat, etc., allowed about the seventeenth or eighteenth day.

The patient was transferred to the jail on March 11, and after pleading not guilty to an assault with attempt to kill, was convicted and sentenced to the State Penitentiary at Salem, Ore., where he is now confined.

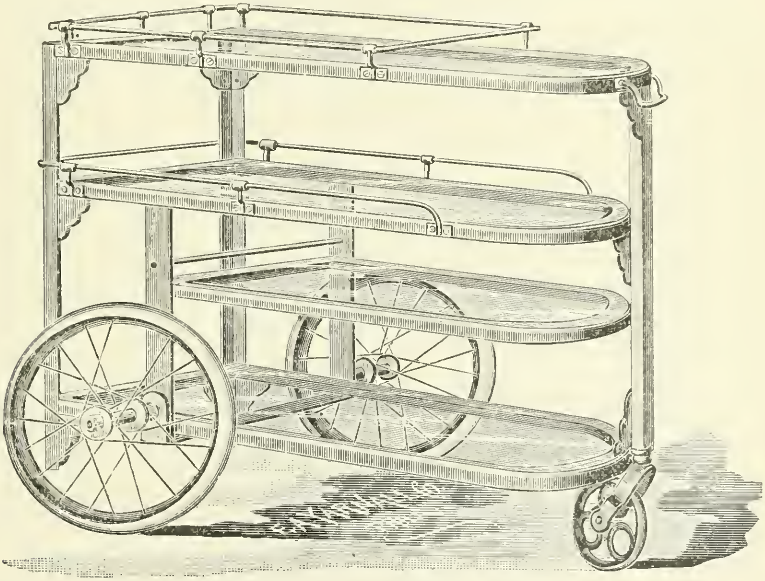
# A NEW WARD SURGICAL DRESSING CARRIAGE.

By GWILYM G. DAVIS, M.D., M.R.C.S. (Eng.),

OF PHILADELPHIA,

SURGEON TO THE GERMAN AND ST. JOSEPH HOSPITALS; ASSISTANT SURGEON, ORTHOPÆDIC HOSPITAL.

THE present is not only the era of aseptic operative surgery, but is also pre-eminently the era of aseptic hospital furniture. All over our land, as rapidly as finances permit, the various institutions are substituting furnishings made of glass and iron for those previously made of wood. The needs of the different institutions, as well as the tastes and practices of the surgeons, vary so much that many different patterns of a single article are found desirable. The many styles of operating tables is an example. The accompanying sketch represents a ward carriage devised by me for the Philadelphia Orthopædic Hospital and intended to be used for ordinary surgical cases. The cut shows its general appearance. It is made of white enamelled one-inch angle iron and has four plate-glass shelves. The length is forty-two inches, and width twenty. The back is square while the front is a semicircle, the shelves being joined together at the front by a solid one-inch square rod of iron. The top shelf is thirty-eight inches from the floor and has on it a brass railing three inches high (the cut incorrectly makes it appear lower). This railing only extends about two-thirds of the way forward, leaving a free space in front. The second shelf, placed thirteen inches below the top, has a brass rail only one inch high. This rail also does not go all the way front. From the second to the bottom shelf, near the back, runs a side-piece of strap iron which adds stiffness to the frame and steadies the wheels. From this side iron the third shelf goes forward; it is about six inches below the shelf above. The two back wheels are of the bicycle pattern, while the front one is small and turns on a pivot; all are rubber tired. On the top shelf can be carried antiseptic solutions and dressings in flat-topped glass jars. On the second shelf may be kept additional glass jars with bandages, towels, prepared gauze, sterile cotton, small glass boxes, etc.; these latter will be kept from falling off by the rail which is only one inch high. On the third shelf towards the back can be kept padding for splints, etc., and in front the pus basin and basins for solutions. At the back of the lowermost shelf there is room for the largest size pitchers, for solutions, and forward additional pitchers holding a gallon and a half to two gallons can be placed. On Kocher's ward carriage there is a rack of wire netting suspended above the top shelf for bandages. This has not been used because it serves to accumulate dust, which drops on the dressings beneath. No provision is made for refuse material, the receptacle for this should be kept away from the carriage entirely. As some surgeons desire an irrigation apparatus, that devised by Dr. Burton K. Chance



Davis's ward surgical dressing carriage.

may be added; it consists of a rod of iron fixed by clamps to one of the corners of the carriage; when in use, one of the clamps is loosened, the rod raised, and so clamped. The receptacle holding the irrigating fluid is then hung from a hook at the top. If so desired, an irrigation tube may be attached to one of the solution bottles on the top of the carriage. The clear surface on the front of the top and second shelves is intended for placing the instruments, prepared dressings, solutions, etc., when in use. They are also of service in spreading ointments.

The use of a single support in front and doing away with the corners makes this part of the carriage particularly accessible. It is made by E. A. Yarnall Company, of this city.

# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, April 24, 1895.*

The President, ROBERT ABBE, M.D., in the Chair.

## SUBDURAL IMPLANTATION OF RUBBER TISSUE FOLLOWING TREPHINING.

DR. ABBE presented a man, thirty-five years of age, who, some years previously, had had syphilis. It had caused no further trouble after the early manifestations until within a year and a half, when, while looking out of a window, the patient had an epileptic seizure beginning in the right hand and passing into a general epileptic convulsion with loss of consciousness. He afterwards had repeated epileptic seizures of the same type, always commencing in the right hand. Until three months ago the seizures occurred at intervals of about a month, then began to be more frequent, and finally, before the operation, five weeks ago, occurred once or twice a day. A part of the time he had been under the care of Dr. Graeme M. Hammond, who had given the usual antisyphilitic and epileptic treatment, but without benefit. Dr. Hammond regarded the case as one of cortical irritation in the hand centre because of the uniform seizure of the hand first, and suggested operation. Dr. Abbe made a large horseshoe-shaped incision with the chisel, exposing an area of dura about two inches in diameter over the hand centre. The appearance of the dura was that of chronic pachymeningitis with unusual thickening. Two-thirds of a circle, an inch and a half in diameter, was cut into the dura, the flap, which was firmly adherent to the pia and brain beneath, had to be dissected up and was turned back. The dissection was difficult, but was done without injury to the brain substance. Radiating from the hand centre, the dura was found less and less adherent. Feeling that, if the parts were simply replaced and sutured, adhesions would form again and the patient would not be permanently benefited, he thought of carrying out the method practised by Dr. Beach, of Boston, of inserting a piece of gold-foil between the brain and dura. Not having any at hand, he substituted a piece of sterilized gutta-percha tissue an inch in diameter. Primary union took place throughout the depth of the wound. Aside from a slight seizure in the hand at the end of forty-eight hours, the patient had been entirely free from his attacks since the operation, a period of eight weeks. The medical treatment had not been different from what it was before the operation.

As to the ultimate fate of the rubber tissue, he said it was a matter of conjecture with him as to what would become of it. He had never before implanted it. His impression was that it would remain embedded as a bullet might. The point to be gained, as far as one could see, was limitation of local irritation in the hand centre. He had seen Dr. Beach's case about two years ago, that of a girl in whom the attacks recurred after the first operation of freeing the dural adhesions to the brain. On this occasion nothing was done to prevent reformation of the adhesions. After about two months Dr. Beach reopened the wound and laid a piece of gold-foil between the dura and brain and closed the wound. He was criticised by those who thought adhesions would form around the circumference of the gold-foil and give rise to just as much irritation as had existed before. Dr. Abbe saw the patient about six months later, and there had been no recurrence of the attacks, and he understood there had been none since.

Dr. F. Tilden Brown mentioned a case which he had seen operated upon by Dr. A. J. McCosh. The patient had some arm symptoms, Dr. McCosh trephined, freed the dural adhesions to the brain, inserted a thin sheet of celluloid beneath the dura, closed the wound, and the patient was entirely relieved. For some reason the celluloid became displaced in the wound and the patient returned to the hospital. The wound was reopened in order to investigate the celluloid, and it was found to have become curled up at one end. Whether this had happened while it was being placed in position or subsequently was unknown. Shortly after the plate was taken out the patient began to complain again of his old discomfort and asked to have it replaced, which had been done and he had since left the hospital. Dr. Brown inquired of Dr. Abbe what means he had employed for incising the bone.

Dr. Abbe replied that he used the Hartley grooved chisel, making a horseshoe furrow, the furrow itself less than half an inch wide.

It had not been necessary to go through the deeper plate at all parts. The bone cracked easily when pried up from one margin. It was a matter of surprise, too, how easily the untouched bridge at the open end of the horseshoe cracked, and in a straight line, when the divided circle of bone was lifted.

## ACTINOMYCOSIS HOMINIS.

Dr. P. Syms read an account of a case of actinomycosis.

Dr. W. W. Van Arsdale said that his experience with actinomycosis in this country had been limited. He had had opportunity to see several cases abroad, and one of his friends, a celebrated historical writer, had died of the disease. In that case it had begun near the spine and had travelled through to the sternum, causing much suffering for several years.

About a year ago he had had a case which he was now certain was one of actinomycosis, although at the time he was sceptical about it, inasmuch as the specimens found in the pus resembled leptothrix, none having the club form, which he then thought was necessary in order to establish the diagnosis of actinomycosis. The patient was a well-nourished woman of about thirty-four, and the affection was in the parotid region, from whence it spread forward. The patient stated that it had started in a carious tooth. The face showed thick, indurated excrescences which could be traced under the skin. He made injections about twice a week of a solution composed of fourteen grains each of acid cinnamyl and muriate of cocaine in four drachms of alcohol, using ten or twelve minims at each injection. He had heard of this acid from Landerer, who had used it for another purpose. The effect was beneficial in preventing the spread of the disease, but it took some time to get it under control. During the latter part of the period he had also given iodide of potash, not because he had yet heard of this drug being curative of actinomycosis, but because the patient had been under the care of another physician in the same institution who had made the diagnosis of syphilitic disease, and he continued the antisyphilitic treatment. Whether the credit was due to the injections or to the iodide of potash, the patient was completely cured. He would repeat that while there were yellow bodies in the pus, no clubs were found, although repeated examinations were made by himself and by an expert bacteriologist; nothing was found but threads similar to leptothrix.

Regarding the case reported in the paper, which he had seen subsequently, he at first suspected syphilitic disease, but Dr. Gallant, who was working with him at the time and who had seen the case with Dr. Syms, told him that a positive diagnosis of actinomycosis had previously been made. Having by this time heard that iodide of potash was useful in these cases, he gave the patient fifteen grains three times a day for three months. When she first came to him she looked in every way like a person who was about to die of cancer. She could not walk alone, but had to be supported by two people, and evidently was in the last stage of exhaustion. Under the treatment she had become strong, could walk to and from the clinic, and was very much improved in body and spirits. When she had first come to him there were large openings and sinuses in the abdomen, about seven in number, which were discharging a good deal of pus. All had since closed and formed indurated masses with the exception of two or three small spots which continued to form crusts.

# TRANSACTIONS OF THE SECTION ON GENERAL SURGERY OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA.

*Stated Meeting, March 8, 1895.*

O. H. ALLIS, M.D., President, in the Chair.

## LIGATION OF COMMON CAROTID ARTERY FOR ORBITAL ANEURISM.

DR. THOMAS G. MORTON presented a patient showing the result of a ligation of the right common carotid artery, performed in December, 1864, for aneurism of the orbit.

The patient, then thirty-six years of age, was in March, 1864, awakened from sleep by a noise in her head which sounded like the report of a pistol. She at once felt pain in the right eye, which soon became prominent and pulsated. There were present also dilated pupil, impaired vision, and general venous fulness of the vessels of the eye and brow.

Pressure on the carotid controlled the pulsation and bruit. The carotid was tied in December of the same year. The symptoms promptly disappeared, and the patient has continued in good health since.

## TRAUMATIC ANEURISM OF BOTH EXTERNAL ILIAC ARTERIES.

DR. MORTON presented a second patient, referred to him by Dr. A. H. Halberstadt, of Pottsville, with the following account:

The man, twenty-five years of age, was walking on ice a month previous, carrying in his hands bundles weighing sixteen pounds. He slipped, but recovered himself and did not fall. He immediately felt some discomfort at the lower part of the abdomen. This increased afterwards from day to day, until the pain became great. It was attended by heavy throbbing of the vessels in the left groin, contraction of the muscles of the leg, and numbness from the knee down, and loss of knee-jerk. After two weeks the aneurismal pulsation ceased, leaving a thick corded line along the track of the large vessels. The same character of pulsation appeared on the right side three weeks after the appearance of the first symptoms, but they are as yet unattended by much pain or numbness, and the knee-jerk continues normal.

Examination revealed a large, irregular, non-pulsating tumor with feeble bruit occupying the left groin, and absence of pulsation in the vessels of thigh or leg; complete numbness in the distribution of the anterior crural nerve, total absence of patellar reflex, thigh somewhat swollen, being two inches more in circumference than the right.

In the right groin is a small pulsating tumor about the size of a walnut, with marked aneurismal symptoms and with very feeble circulation below this point. The right thigh, which has been kept flexed since the accident, cannot be extended owing to muscular contraction.

It seems probable that incident to the violent strain both iliacs were injured, the left more than the right, with rapid development of a tumor, which by pressure involved the anterior crural nerves. Consolidation of the aneurism in the left side apparently has occurred naturally, and improvement has taken place in the circulation of the limb, and comparative freedom from the pain, which has been intense.

On the right side the tumor is not large, and its pulsation is easily controlled by pressure on the artery. That the discovery of the disease on the right artery was not made earlier after the accident was doubtless due to the great preponderance of symptoms on the left side.

With regard to the treatment, it would seem that since favorable progress is going on in the tumor in the left groin, it is reasonable to expect that nature may complete the cure without any operative interference. As regards the active aneurismal tumor on the right side, ligation of the iliac may be required if the disease continues to develop or serious symptoms appear, but the patient has improved so much that delay seems more than justifiable.

## DIFFUSE ANEURISM.

DR. EDWARD MARTIN reported four cases of diffuse aneurism with operation and cure.

## VARICOSE ANEURISM OF THE THIGH.

DR. JOHN B. ROBERTS reported "A Case of Varicose Aneurism, the Result of a Pistol-Shot Wound." (See page 372.)

DR. JOHN ASHHURST, JR. remarked that his experience with varicose aneurism had been limited to two cases, and that he had seen at least one case of aneurismal varix, in the person of an army officer, who had a marked aneurismal varix of the femoral artery and vein, caused by a musket-ball which had passed between them. In such cases no operation is, as a rule, needed, since the condition is not progressive. In neither of the two cases of varicose aneurism which he had seen was any operation required. In one, a case shown him by Professor Osler, of Baltimore, the history was that the patient had a pointed lead-pencil in his vest-pocket, and that by a fall the pencil was driven into his axilla, wounding the artery and vein. Subsequently a pulsating sac was developed, but as this was stationary when he saw him, he advised against any operation.

The other case occurred in the person of a medical man, who was using a pair of scissors or a knife when the blade slipped and entered the upper portion of his thigh. The wound soon healed, but a varicose aneurism formed at the place of injury. Here, too, when he saw the case the sac was not getting any larger, and he therefore advised against interference. The treatment in this case was to make slight pressure with a pad over the sac, and also to wear a truss so as to make constant gentle pressure upon the iliac artery at the groin. With this apparatus the patient is able to attend to his professional duties without inconvenience.

When any operation is required for varicose aneurism, it is proper to ligate both ends of the artery, but not the vein. He did not think it to be good practice in these cases to tie the vein as well as the artery.

As to diffuse traumatic aneurism, the name is really an incorrect one, because the lesion is essentially one of wound of an artery, and not an aneurism in the true sense of the term. The proper treatment in these cases is to lay open the swelling and tie both ends of the artery at the site of rupture, unless the circumstances render amputation necessary. In diffuse traumatic aneurism in the upper extremity, or in the femoral artery, ligation would ordinarily be the best operation, but if the popliteal artery were the one affected, amputation would commonly be safer.

Dr. J. M. Barton said that in cirsoid aneurism the injection of alcohol had been found useful, and may take the place of the radical operation recommended by Dr. Ashhurst. He had used it in full strength. It can be injected safely. In a recent case of nævus of the cheek he had made twenty to thirty injections with complete success. He thought that this treatment deserved more attention than it had yet received.

## ANEURISM OF THE ANTERIOR TIBIAL ARTERY.

Dr. DeForest Willard presented a specimen of aneurism of the anterior tibial artery just at its origin where it pierces the interosseous membrane between the tibia and fibula.

The history of the case was that of pain following a long and severe walk. The head of the fibula was driven outward forcibly at each pulsation, and the bruit was marked.

The case was cured by digital compression of the femoral artery, pulsation ceasing in forty-eight hours. Treatment was continued as a precautionary measure for another day. Cure was complete, and the relief from pain. which had been very severe, was marked. He died some years after this of another disease, when the specimen was obtained and showed obliteration of the lumen.

## ANEURISM OF THE AORTA.

Dr. Allis presented a specimen removed post-mortem from a negro man who had suffered from aneurism affecting the right and upper side of his thorax. He had been a porter in a Pullman car, and upon one occasion, as he was putting up a berth, the car slewed round and gave him such an injury that he had to give up his work. He rapidly grew worse until death occurred. This specimen showed an aneurism of the first part of the aorta, which had eroded the ribs and extended to the branches in the neck.

## POPLITEAL ANEURISM.

Dr. W. W. Keen exhibited a patient whose femoral artery was tied after failure of compression for popliteal aneurism. J. B., aged fifty-four years, entered the Jefferson College Hospital, March 3, 1892.

Family history good. In 1864 he contracted syphilis. He was under treatment a very short time and never noticed, after the disappearance of the eruption, any further outbreak. Being a night-watchman in a chemical works he had to make eleven rounds every night, climbing forty-four flights of stairs, eighteen steps to the flight, making an aggregate of 1584 steps every night. Six months before admission to the hospital he noticed a small tumor in his left popliteal space, from which date it progressively grew in size with corresponding increase in pain.

Soon after admission forced flexion was tried, but this, though pushed to the limit of endurance, was not sufficient to arrest the pulsation in the popliteal artery.

March 26, 1892, a graduated compress and bandage were applied to the femoral artery without success, and then a shot-bag was used, which only partially arrested the circulation. A three-pad tourniquet was then resorted to, but the discomfort was too great.

April 8, the femoral artery was tied at the apex of Scarpa's triangle with silk, the "stay knot" of Ballance and Edmund's being used. Six days later pulsation was detected in the dorsalis pedis, but none in the aneurism. He was discharged in three weeks.

March 8, 1895. The patient has been entirely well ever since, but he has had other night duties assigned him in place of climbing so many steps.

## VENOUS ANGIOMA OF THE HAND.

Dr. W. W. Keen also reported the following case: Miss G. F., aged seventeen years, entered the Jefferson Hospital, January 1, 1895. Seven years before an older sister pushed the ring-finger of her left hand into hyperextension. This caused severe pain, but did not interfere with motion. For two months afterwards the knuckle-joint was painful. At the end of this time a small swelling appeared on the dorsal surface of the hand immediately between the knuckle of that finger and the little finger. A short time later a similar swelling appeared on the palmar surface. When admitted, these swellings had greatly increased in size and had become not only painful, but had produced a mechanical disability in the hand. Between the ring and little finger on the dorsum there was a bluish mass extending half the length of the metacarpal bone. On the palmar surface it extended up to the joint and on a level with the web of the thumb.

January 9, 1895, an incision was made first on the palmar surface, and later on the dorsal surface of the hand. The mass of veins was dissected out with much difficulty after a great deal of time. The operation required over an hour. She made an uninterrupted recovery. Her highest temperature was 99½° F.

## VENOUS ANGIOMA OF THE FOOT.

Dr. W. W. Keen also presented a boy, aged twelve years, who had been cured of a venous angioma of the dorsum of the foot by its removal. Seven years before coming under his care the boy fell and sprained his ankle. He recovered from the accident, but there remained always some swelling on the outer side of the left instep; six months before admission he was struck with an apple on the site of this swelling, after which the pain and swelling prevented his walking, except with considerable difficulty.

When admitted, on the left instep, over the site of the extensor brevis digitorum, was a swelling which was soft, elastic, semifluctuating, without thrill, bruit, or pulsation ; no enlargement of the veins, no dislocation ; in fact, except for the swelling, semifluctuation and moderate pain, the symptoms were negative.

May 18, 1894, an incision was made in the long axis of the foot, and a venous angioma, consisting of a mass of varicose veins, was revealed. The veins bled profusely ; seizing them with hæmostatic forceps at many points did not do the least good. The moment they were seized, the veins would bulge out like distended bladders, and at not a few places ruptured. Efforts to control the bleeding by ligatures passed deeply were likewise futile. An Esmarch bandage was then applied and the anterior tibial vessels were exposed and tied, and also the bleeding points in the mass itself. When the Esmarch bandage was removed the mass bled quite as freely as before. He then proceeded to dissect out the whole mass while an assistant compressed the femoral artery at Poupart's ligament. He made an incision which extended from over two inches above the ankle down to the roots of the toes. This was crossed by another incision over the instep, from one side of the foot to the other. The mass of distended veins lay immediately next the bone under the extensor tendons, and especially had invaded the belly of the extensor brevis and the edge of the muscular belly of the flexor longus pollicis, extending also under the anterior annular ligament and a little above its upper border.

He began the dissection at the root of the toes, where he found normal vessels; dissected up the mass towards the ankle, having to dissect the veins from the inner and outer border of the whole foot, removing the entire belly of the extensor brevis, and part of the belly of the extensor longus pollicis. He was compelled to partially divide the anterior annular ligament, in order to follow the diseased veins into the leg. At two points he opened into the joints, so intimately were the veins coalesced with the deep structures. Finally, he was enabled to remove the entire mass, having applied around the periphery about a dozen ligatures. The hæmorrhage then ceased. A portion of each of the four flaps sloughed at the point of crossing of the two incisions. Excepting this the entire wound healed by first intention.

March 8, 1895. The boy's foot is in excellent condition.

Dr. Keen said that this case was one of the most difficult that he had had for a long while. At one time it was even a question with him whether the hæmorrhage would not be so severe and uncontrollable as to necessitate an amputation of the leg. Had the final expedient of tying the vessels at the periphery not been successful this would certainly have been the case. As it was, though the dissection was tedious and difficult, yet, finally, it was entirely successful, and the result has been all that could be wished.

# INDEX TO SURGICAL PROGRESS.

## ABDOMEN.

**I. Contribution to the Surgery of the Stomach.** By M. MONTAZ (Grenoble). The author reported thirty-five cases of surgery of the stomach. These are classified as follows: Six gastrectomies, six gastrostomies, ten gastro-enterostomies, two jejunostomies, and eleven exploratory abdominal sections.

Of the six gastrectomies three died and three were cured. The deaths were all due to operative collapse. Of the three who recovered from the operation two suffered from a recurrence within a short time, and one remains free from disease at the end of more than a year. M. Montaz performs gastrectomy in simple cases only,—that is to say, in cases where the tumor is small and is easily movable. In performing the operation the stomach is first exposed and rapidly isolated by tearing away with the fingers the greater omentum and the gastro-hepatic omentum. Two Richelot clamps, faced with rubber, are then applied to the walls of the stomach some distance from the tumor; the intervening tissue is quickly cut away with scissors, and the divided edges are sutured together after the method of Doyen (la suture en surjet).

In the six cases where, owing to the impossibility of a complete ablation, gastrostomy was done, there were six operative cures. The technique described by Terrier was exactly followed in all cases. Notwithstanding the narrowness of the orifice there always occurred an escape of gastric juice and a digestion of the stomach-wall. A great variety of substances were tried to avoid this digestion, but without avail; the stérésol of Berlioz seemed to be of most value.

The ten gastro-enterostomies gave seven cures and three deaths from the operation, all the latter occurring from collapse. The anterior operation of Wölfler was used in each case. Three patients of the seven who recovered have had regurgitations of bile following the ingestion of food, but without any particular distress. Aside from the inconvenience resulting from this occurrence, the patients have all done well, and Montaz regards the duodeno-jejunostomy of Jaboulay as useless and dangerous.

The two jejunostomies were performed for the relief of patients suffering from very extensive cancer of the stomach, in whom alimentation had become impossible. The jejunum was identified, and an artificial opening was made in it precisely as if it had been the stomach. Through the opening thus made the patient was fed, and each lived for some months.

The exploratory sections were all done upon patients suffering from single or multiple cancers. All stood the operation well, and in some there was a marked amelioration of their symptoms for a time.

These good results which M. Montaz has obtained he attributes to careful antisepsis. The field of operation was prepared in the following way: Vigorous brushing with microcidine, then sublimate lavage, and finally a strong solution of carbolized glycerin, which was allowed to remain in place for ten minutes before the operation was begun. Microcidine has the advantage of not affecting the instruments.—*Transactions of the French Congress of Surgery*, 1894.

HENRY P. DE FOREST (Brooklyn).

**II. Case of Diffuse Suppurative Peritonitis following a Perforating Appendicitis conducted to Recovery.** By Dr. BERGER (Paris). The author has opened the abdominal cavity many times for the condition of diffuse septic peritonitis due to a perforation of the appendix, yet in only one case has a recovery been secured. This case he reported to the Society of Surgery of Paris, July 25, 1894. The fortunate termination he attributed to a systematic and complete washing out of the peritoneal cavity which he was able to make through three separate incisions, and by subsequent multiple drainage of the cavity. The patient was a young man, twenty-one years of age. The symptoms of appendicitis and of general peritonitis had already been present for three days. The abdomen was opened by the usual lateral incision in the right iliac region, and a large quantity of turbid and flocculent liquid at once escaped. No adhesions among the intestines had formed. A perforation in the appendix at the level of its insertion into the cæcum was found, but the state of the parts did not make excision of the appendix practicable. The cavity of the pelvis was filled with thicker and more fetid fluid and pus. From the region of the umbilicus and of the left iliac fossa large quantities of fetid turbid fluid escaped. Everywhere the peritoneal surface was gluey and covered with flocculent exudate. To more certainly cleanse the abdominal cavity, a second incision was made in the linea alba above the umbilicus, and a third in the left iliac region. Through each of these incisions, in succession, a glass tube was carried into the most distant recesses of the peritoneal cavity and copious streams of warm sterilized water were made to flow through them until the injected water returned almost entirely clear. Through each of these incisions a large rubber drainage-tube surrounded with salol gauze was then introduced, one penetrating to the left flank, a second to the bottom of the pelvis, and the third to the right iliac fossa, where the cæcum and the appendix were surrounded with strips of the salol gauze so as to shut off as much as possible the primary seat of infection. The patient bore the operation well ; but for some days continued to vomit everything swallowed. The belly became more and more distended ; no gas or fæces escaped by the anus ; on the third day the tampons were withdrawn from the linea alba and from the left iliac fossa, and that in the right side was changed, no fluid escaping. The fourth day all the symptoms were increased in gravity ; on the fifth day delirium supervened ; on the sixth day, after a copious enema, the situation entirely changed for the better. Copious evacuations resulted, followed by diarrhœa ; the tympanites subsided and the vomiting ceased. Attempts at feeding at first provoked new vomiting and it was not until the twelfth day that liquid food was borne. From this time a steady convalescence.—*Bulletins et Mémoires de la Société de Chirurgie de Paris*, 1894, t. xx, p. 625.

**III. Experimental Appendicitis; some Researches as to the Mechanism of Perforation of the Appendix.** By M. Roux (Lausanne). The mechanism of perforation of the appendix is little known; it has been attributed to an ulceration caused by the presence of a calculus, to an ulcerative lesion caused by compression of the vessels, to a dilatation of the appendix from retention of mucus, and, finally, to an infective process.

M. Roux has studied the question experimentally, and chose swine as suitable subjects. The colon was drawn out, the cæcum isolated, and an artificial appendix made by passing a row of parallel silk threads around it just beneath the serous coat, and drawing them moderately tight. Farther up in the cæcum an incision was made, and through this foreign bodies were introduced. Sixty-seven swine, and two dogs were thus operated upon; the two dogs died in twenty-four hours from gangrenous peritonitis. Two swine also died from faulty technique; the others bore the operation with scarcely any reaction.

The results as to a formation of an artificial appendix were good. The silk cut through, and was passed from the anus, the pocket persisted. At the end of some months the foreign body had disappeared, the mucous membrane was found to be intact. In a single case a suppurating appendicitis was produced.

The presence of a foreign body alone, therefore, was not sufficient to cause perforation; some other factor must be added. M. Roux thinks that upon the occurrence of a traumatism or a chill the mucosa becomes turgid, presses firmly upon the foreign body, and the circulatory disturbances which result ultimately lead to gangrene and perforation.—*Transactions of the French Congress of Surgery*, 1894.

**IV. The Radical Cure of Umbilical Hernia, with a Series of Twenty-nine Cases (Eighteen Umbilical, Eleven Epigastric.** M. Lucas-Championnière (Paris). Umbilical and epigastric hernias are not submitted to the operation for radical cure as frequently as are the other forms of hernia, but, notwithstanding the disinclination on the part of both patients and of physicians to have the operation performed, Championnière has operated a number of times, and the statistics of his results are of great value. It is time to draw attention to the necessity of making the operation a more common one, and to it should be applied all of the principles of radical cure of hernia in any situation.

Ordinarily such hernias are permitted to become of enormous size. They cause great inconvenience. They are, practically speaking, never controlled by bandages, even by those which support their weight, and give relief from the sense of pressure. They should be classed with those conditions which lead to a rapid organic decadence of strength, such as diabetes, albuminuria, and early senility. They are nearly always complicated by obesity and pulmonary emphysema. One should not think that if they are allowed to steadily develop in size and severity that one will still remain master should the question of cure arise. Even after the most successful operations upon large umbilical hernias, there is always great danger of a recurrence in the cicatrix, and still more in the lateral portions where the wall is weak. On the other hand, when the operation is performed with the hernia still small, permanent radical cures may be obtained.

Umbilical hernia presents itself in such a great variety of forms that it is impossible to lay down any exact rules for the manner in which the operation should be performed. Nevertheless, as in other hernias, the general indications are as follows: obliteration of the hernial sac, firmly uniting the membranes which form the constricting ring, and a final apposition of the walls by tiers of sutures so that the cicatrix will be as firm as possible.

The excision of the umbilicus is a necessity in most cases where the sac is dissected away. In case the hernia complicated a cyst of the ovary, the umbilicus may be very large.

The greatest difficulty in cases where the hernia is very large lies in the treatment of the abdominal wall, for if there be considerable tension allowed to exist after the operation the chances of recurrence are greatly increased. Championnière strongly recommends that all of the hernial omentum be resected, and as much more as can be drawn out. In the operations which he has done, he has cut away masses of omentum weighing, respectively, 573, 482, 412, 245, 423, 272, and 95 grammes; the hernias were, therefore, in many cases large ones, and the removal of such large masses of tissue materially reduced the danger of a recurrence.

Not being able to cross the layers as in an inguinal hernia, he multiplied the tiers of suture; first suture of the serosa, by either interrupted or purse-string sutures; then a fibro-muscular layer; then a second fibro-muscular layer in front of the first; then a third fibro-muscular layer passing behind the other two. This firm cicatrix having been constructed, the skin was united with drainage provided for just beneath it.

In those cases where the hernial mass did not exceed the size of an egg the immediate and final results have been excellent. In the hernias of larger size the results were also good, but the danger of a recurrence is very great. In the largest one upon which he operated (seventy-five centimetres in circumference) the scar was still firm at the end of two years; somewhat later it became weakened, and a recurrence appeared. In case of these large hernias the wearing of a belt prevents and retards the return of the trouble.

The omentum is no protection to the wall, and is a source of weakness in case it becomes adherent.

Notwithstanding the co-existence of many grave complications, the results in all of the eighteen cases have been good.

He believes that the true surgical treatment of umbilical hernia consists in an early operation, and in never permitting the hernia to become of large size.

Considering the extreme gravity as regards the general health of the patient if the hernia steadily increases, the danger of strangulation of the hernia, and the danger of a fatal result if the size be very large at the time of operation, M. Championnière advocates the operation at the beginning of the hernia.

Championnière has also operated upon eleven cases of epigastric hernia, one patient having two hernias of this variety. As contrasted with umbilical hernia, this form of hernia never tends to materially increase in size, and, instead of being almost painless, is usually the cause of severe distress, with vomiting and a variety of intestinal lesions which are difficult to explain in many cases. The palliative treatment of this condition has little to offer. In only one case of those observed was a bandage able to give any relief.

The operation is easy and the results are efficacious and satisfactory. The hernial orifice should be freely incised; the sac drawn out and opened, and the omentum which it contains detached and excised. After ligating the pedicle of the sac it is cut off as much as possible. The walls of the wound are then sutured together; first a line of sutures in the serosa, and then a second tier is introduced to strengthen the first. The skin wound may be closed with or without drainage.

This operation was in all cases followed by the best results; the wound remained firm, and in no case was there a recurrence of the hernia. The difference in character between these two forms of hernia, which are such near neighbors in point of position, is quite remarkable.—*Transactions of the French Congress of Surgery*, 1894.

HENRY P. DE FOREST (Brooklyn).

**V. Telescopic Anastomosis of Sigmoid Flexure of Colon into Lateral Opening in Rectum.** By HOWARD A. KELLY, M.D. (Baltimore). The patient was a woman, twenty-two years of age, suffering from an artificial anus, sequel to an attempt to enucleate and remove the uterine appendages which were involved in an extensive mass of pelvic exudate, in the course of which attempt, after one tube and ovary had been removed, a section of a contracted and thickened sigmoid flexure had been mistaken for the remaining tube and had been tied off and excised. When this mistake was recognized, the cut ends of gut were sewed into the abdominal wound and the operation abandoned. Two months later the patient came under Dr. Kelly's care, who relieved her by the following procedure: The scar containing the sigmoid and rectal orifices was dissected out; the pelvic organs were enucleated, and the remaining tube and ovary and the uterus were excised. The redundant contracted upper portion of the rectum was cut away and its lumen closed by suture. The free end of the sigmoid was then caught with six long silk traction sutures passed through the peritoneal and muscular coats, entering about a half a centimetre from the edge of the incision, and emerging on the incision, without piercing the mucosa. The walls of the bowel were from three to four millimetres thick and somewhat rigid, without the flaccidity of the normal sigmoid.

An oblique incision was then made into the rectum on the pelvic floor just above and behind the vagina close to the cervix, below the lower end of the stricture. This incision, made through the abdominal incision, was about three centimetres long, and directed from before backward from left to right, the greater part lying to the left. With a pair of long artery forceps passed through the anus and ampulla and out through the incision into the pelvic cavity, the six traction sutures were caught in a bunch and pulled down and out of the anus, drawing the sigmoid into the rectal incison, which was held open with forceps to facilitate the entrance. The bowel was then kept from slipping back into the pelvis by grasping the traction sutures in the heel of the bite of a forceps lying across the anus in the gluteal furrow. A rectal examination showed that about one centimetre of the sigmoid projected into the rectum. The fit of bowel into bowel at the incision as seen from above was such a snug one that the line of division between sigmoid and rectum could not be detected.

Fixation of the anastomosis by means of a few sutures uniting the sigmoid to the rectum, passed on the pelvic side, could not be carried out, as there was too little room between the bowel and the pelvic walls to permit the use of either needle-holder or needle.

The pelvis was washed out and a gauze pack inserted around the sigmoid, and another up among the inflamed bowels and brought out at the lower angle of the incision, which was closed to this point. The patient made an excellent recovery and has since had normal bowel function. At no time did she pass fæcal matter in any other way than per anum.—*Johns Hopkins Hospital Bulletin*, February, 1895.

## EXTREMITIES.

**Direct Digital Compression of the Common Iliac Vessels in Disarticulation of the Hip.** By M. CHALOT (Toulouse). The author has devised a method of disarticulation of the hip-joint by means of which the danger of hæmorrhage is reduced to the same degree as in other amputations. A button-hole incision is first made through the abdominal parietes just inside of the anterior superior spine of the ilium ; the peritoneum is stripped up and pushed aside, and the fingers are passed beneath this reflected layer as far as the angle formed by the psoas muscle and the sacral promontory ; there the termination of the common iliac artery is found and compressed. The disarticulation can then be done in whatever manner is deemed best under the circumstances. It should be remembered that the upper end of the divided femoral vein may bleed from reflux, notwithstanding the fact that the common iliac vein be compressed at the same time as the artery.

Chalot carried out this plan in the case of a man, twenty-one years of age, who was suffering from an encephaloid sarcoma involving the fleshy part of the thigh. The execution was easy, and the patient was cured.—*Transactions of the French Congress of Surgery*, 1894.

HENRY P. DE FOREST (Brooklyn).

## MALE GENITO-URINARY ORGANS.

**I. The Diagnosis and Treatment of Malignant Tumors of the Kidneys in Adults.** By Dr. THORKILD ROVSING (Copenhagen). Since the first malignant tumor of the kidney was removed by Kocher, eighteen years ago, the operation has been done 150 times, with a mortality from the operation of 50 to 66 per cent.

before 1890, and a mortality of 20 to 25 per cent. since then. Wagner has found seventeen cases which have lived a year or more after the operation, but many of these have died of recurrence at a subsequent date. The large mortality has been due to the fact that the diagnosis was not made early enough, and the operation was undertaken when the tumor had reached a large size and formed numerous adhesions. The early diagnosis of these tumors is a chapter which surgeons have neglected.

Clinically the tumors may be divided into the following three groups:

(1) Cases in which a palpable tumor is the first and only symptom. Cases of this kind are not rare, but the diagnosis during the early stages is difficult or impossible. The tumor usually begins in the suprarenal capsule or the upper part of the kidney and reaches a large size before it is discovered, moreover, they may be mistaken for multilocular cystoma, a condition in which operation is contra-indicated, as both kidneys are affected.

(2) Cases with hæmatinuria and a palpable tumor. Typical cases of this kind are easy to diagnose, but they are rare. They are frequently complicated with attacks of renal colic, the urine contains a large quantity of inorganic matter and crystals, making the differential diagnosis from nephrolithiasis very difficult, especially as the kidney is also enlarged in that disease.

(3) Cases of hæmatinuria without a palpable tumor. The early diagnosis presents great difficulties, but it is of the utmost importance, as tumors of this class are usually operable. Hæmorrhage from the bladder can be excluded in that the blood is more intimately mixed with the urine, and instruments passed into the bladder cause no fresh hæmorrhage. The diagnosis is best made by the microscope, as the urine deposits a layer of yellowish-gray granular matter composed largely of round or spindle cells which have undergone fatty degeneration.

The means which we have for diagnosing these tumors are as follows:

(1) A careful family and personal history of the patient. If the patient have a tubercular diathesis one would think of a beginning tuberculosis of the kidney. A rheumatic diathesis or previous attacks of renal colic would indicate nephrolithiasis.

(2) Microscopic examination of the urine is of importance indirectly in that tuberculosis and nephrolithiasis can be diagnosed or excluded ; and directly in that the tumor-cells are frequently found.

(3) Palpation is of but little value except in those cases in which the tumor begins in the lower end of the kidney. The healthy kidney sometimes hypertrophies, owing to increased functional activity, and might easily be mistaken for a tumor.

(4) The use of the cystoscope is very limited. It can be of use only in cases of hæmatinuria when the hæmorrhage is not so profuse that it makes the fluid in the bladder opaque before the ureters can be found, and even if we see blood coming from one ureter we are not sure that it is not caused by hyperæmia of the healthy kidney.

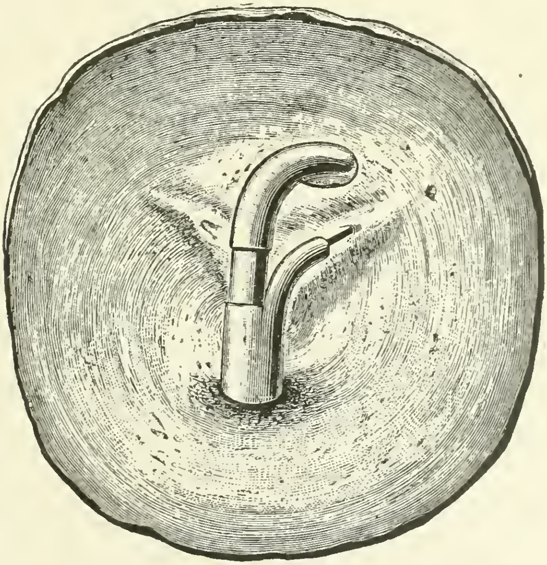
(5) The last resort is an exploratory incision which should be made in the lumbar region. The kidney can be more carefully examined than by the abdominal incision, and statistics show a smaller mortality after removal. If the kidney be found normal, the wound may be closed and the other kidney examined or removed.—*Archiv für klinische Chirurgie*, Band. XLIX, Heft 2.

GEORGE R. WHITE (New York).

**II. Catheterization of the Male Ureters.** By Dr. MAX NITZE (Berlin). It has been proven fairly easy to catheterize the female ureters, as Pawlik and Kelly have shown.

In man the case is different. Brenner, Poirier, and Boiseau du Rocher have not been able by their methods to catheterize the male ureter with any degree of certainty.

We can see the mouths of the ureters so clearly with the cystoscope that it seems as though it would be very easy to introduce an instrument under the guidance of the cystoscope. In the woman, when a small sound is carried in alongside of the cystoscope, it is very easy to introduce it with the aid of the eye into the ureteral opening. But farther than this opening it cannot be made to pass, because after this the ureter takes a direction different from that of the sound, the two forming an obtuse angle. On the other hand, it is very easy to pass an elastic catheter into the ureter if it can be started in at the proper angle. This can be accomplished by shoving the catheter through a hollow sound as far as the ureteral opening. Thus an elastic catheter can be very easily passed under the guidance of the eye. In man this is not so easily accomplished, because here it is not possible to introduce the proper curved sound alongside of the cystoscope. It is easy enough when this hollow sound is made fast to the cystoscope in a case in which it is movable. This is what Nitze has done. When the hollow sound is shoved out as far as it will go, it fits spoon-fashion into the beak of the cystoscope. In this position the instrument is introduced into the bladder without any trouble. The curved tube is then drawn back a little, as shown



Catheterization of male ureter.

in the figure. The eye then sees the catheter projecting from the opening in the tube, and its entrance into the ureter can easily be controlled. The rubber catheter can then be pushed in even as far as the pelvis of the kidney.

Nitze has been surprised to see how easily the operation can be performed, even under difficulties such as the presence of an enlarged prostate. The patient experiences no pain, and no damage is done.

It is of especial importance that in this manner not only can the ureter be catheterized, but by a simple manipulation it is possible in all cases, after the catheter has been introduced to the desired depth, to withdraw the metal instrument and leave the rubber catheter in place.—*Centralblatt für Chirurgie*, No. 9, 1895.

J. P. Warbasse (Brooklyn).

## FEMALE GENITO-URINARY ORGANS.

**I. Operative Treatment of Myomata during Pregnancy and Parturition.** By Dr. Apfelstedt (Göttingen). The author reports the case of a pregnant woman, thirty-three years old, primipara, seen first in the ninth month of pregnancy, in whom a large fibroid occupied the pelvis and formed an impassable obstruction to the birth of the child. She was kept in the hospital until labor began, when the child and uterus were removed by Porro's operation. Mother and child both lived. The mother did not secrete any milk, which may or may not have been due to the removal of the uterus and adnexa.

The best method of treating myomata complicating pregnancy is discussed at length.

Abortion during the early months of pregnancy should never be attempted. The presence of the tumor makes it difficult to empty the uterus, which is usually found to be very tolerant of the ordinary methods of producing abortion. Moreover, the part of the uterus under a myoma is not capable of undergoing normal retraction, and severe hæmorrhage is apt to occur after the placenta is detached. Hellwig and Meyer have reported fatal cases from sepsis. Even if the operation be successful, the woman is left with a tumor, which will probably call for operative treatment at a subsequent date.

Myomectomy during pregnancy has been done thirty-two times, with the following result: fifteen successful, eleven abortions, five died; giving a mortality of 18.8 per cent. for the mothers, and 53.1 per cent. for the children. This operation should be done for the relief of severe pressure symptoms and sloughing of the tumor, but never because the tumor appears to be growing rapidly.

Supravaginal amputation during pregnancy has been done forty times, with a mortality of 30 per cent. As far as our present experience teaches, this operation should be avoided.

In most cases it is best to wait until labor begins. In some instances the tumors are dragged out of the pelvis by the growing uterus, and normal delivery takes place, but in the majority of cases it is best to perform Porro's operation without delay. The operation has been done fifteen times for this condition, with a mortality of 20 per cent.—a surprisingly good result as compared with Cæsarean section (50 per cent.), or supravaginal hysterectomy (30 per cent.) for the same condition, and compares favorably with Porro's operation (29 per cent.) and supravaginal hysterectomy (21.6 per cent.) for other conditions. In the three fatal cases reported the stump was treated by the extraperitoneal method, a procedure usually associated with a high mortality. By intraperitoneal treatment of the stump the mortality ought to be still further diminished.—*Archiv für Gynäkologie*, Band XLVIII, Heft 1.

**II. The Result of Castration for Myomata.** By Dr. HERMES (Halle, a. S.). The author gives an analysis of sixty-eight cases of myomata from the clinics of Fehling and Kaltenbach, besides making use of the statistics of others. The operation was done sixty-eight times, with a mortality of 7 per cent. Of the cases which recovered, 78 per cent. ceased menstruating either immediately or very soon after the operation; 17 per cent. menstruated irregularly and 4 per cent. regularly. In at least one of these cases part of an ovary was left behind, and in others the hæmorrhage was kept up by cicatricial irritation about the stump of the tube or an endometritis. In 94 per cent. of the cases the tumor diminished in size, although menstruation continued in some.

His conclusions are that the operation is contra-indicated for pedunculated, submucous, or subserous tumors, tumors of very large size, or those that have undergone cystic degeneration. For interstitial myomata not reaching above the umbilicus, it is a useful operation and attended with certain results. It should always be carried out if the patient is exhausted from repeated hæmorrhages, or for any other reason she is not able to undergo a long operation. There need be no hesitancy about sacrificing the ovaries, since they are found to be diseased in a large majority of cases.—*Archiv für Gynäkologie*, Band XLVIII, Heft 1.

GEORGE R. WHITE (New York).

**III. Case of Uretero-Cystostomy.** By HOWARD A. KELLY, M.D. (Baltimore). The patient, a woman, had a ureteral fistula in the vault of the vagina, sequel to a vaginal hysterectomy for carcinoma of the uterus. The right ureter was demonstrated to be the one at fault by cystoscopy and sounding of the ureters. Seven weeks after the primary operation the abdomen was opened, and the ureter sought for.

The end of the ureter could not be found on the pelvic floor on account of the rigidity and inflammation surrounding the line of scar tissue between the rectum and bladder. The right ovary and tube were also pinned down to this scar tissue by numerous vascular adhesions. The attempt to reach the ureter at this point was therefore abandoned, and it was sought out at the pelvic brim, where it was readily found after lifting up the caput coli and incising the peritoneum and pushing aside the fat. It was then traced from the point of crossing the common iliac artery down to the pelvic floor, exposing the whole length of the pelvic portion by splitting the peritoneum over its upper surface. The anterior portion of the ureter was involved in the inflammatory material surrounding the scar, which bled so freely that no attempt was made to dissect it out. Four centimetres of the length of the ureter lying directly posterior to the scar tissue were dissected out, and the ureter lifted up from its bed and divided close to the scar, sacrificing as little as possible of its length.

To secure an easy approximation of the free end of the ureter and the bladder, the bladder was now dissected free from its attachments to the horizontal rami of the pubis on both sides, with scissors and fingers, and dropped down into the pelvis so as to extend it and carry it more into the back part of the pelvis. Then a small incision was made through the bladder wall, covered with fat at least a centimetre thick, at the point on the right nearest the ureteral end drawn straight across the pelvis. This incision passed through the peritoneum, and was not more than three or four millimetres in length, and just large enough to receive the ureter snugly.

The under surface of the ureter was then slit up for about four millimetres, enlarging the calibre of its orifice to avoid a stricture, and with a pair of long, delicate forceps introduced through the urethra, the bladder, and through the incision, the ureteral end was caught and drawn into the bladder and held there while it was being attached to the bladder wall by about six fine interrupted silk sutures passed through the muscular tissue of the bladder and peritoneal and muscular coats of the ureter on all sides, beginning with the under side.

The ureter thus dissected out of its bed and attached to the bladder was stretched like a lax cord from the posterior part of the pelvis to the bladder, which lay gibbous and flattened out on the pelvic floor.

The abdominal incision was closed down to its lower angle, where a narrow gauze drain was inserted for fear of leakage. Care was taken in closing the incision not to draw together the peritoneum underlying its lower end, to avoid raising the bladder and indirectly pulling upon the ureter.

No leakage occurred and the drain was removed, and the wound healed without suppuration. Her urinary difficulties were immediately and completely relieved with the perfect restoration of continence.—*Johns Hopkins Hospital Bulletin*, February, 1895.

## BONES, JOINTS—ORTHOPÆDIC.

**I. The Question of Castration as a Factor in the Cure of Osteomalacia.** By Dr. Lidwig Kleinwächter. Since 1879, when the operation of castration for osteomalacia was first suggested by Fehling, it has been done forty-one times, as shown by the tables of Fränckel. Many of the cases were improved or cured; some were not improved. The ovaries in this disease showed no characteristic lesion.

The author reports two cases of Cæsarean section in which the ovaries were not removed, but the patients both recovered from the disease. He thinks that in removing ovaries for osteomalacia we are groping in the dark. If the operation is followed by improvement it is accidental. Before undertaking major operations for the cure of osteomalacia, it is necessary to know something of its pathology, which can only be learned by bacteriological and chemical investigations.—*Zeitschrift für Geburtshülfe und Gynäkologie*, Band xxxi, Heft 1.

**II. Treatment of Bone and Joint Tuberculosis.** By Dr. G. Neuber (Kiel). The author treats tuberculosis of joints and ends of the bones by opening the joint, removing all sequestra and tubercular foci seen, filling the cavity with 10 per cent. iodoform in glycerin, and closing the wound with buried sutures without drainage.

In fourteen cases treated in this way eight healed by primary union, four by granulation without suppuration, and two with slight suppuration.

This method leaves a far better joint than is obtained after resection, and the iodoform and glycerin are claimed to destroy the small amount of tubercular material which may be left behind after the operation.

He has also employed this method in other operations. The wounds are filled with 5 per cent. iodoform and glycerin, and closed by buried sutures without drainage. Primary union is the rule.—*Archiv für klinische Chirurgie*, Band XLIX, Heft 1.

**III. A New Indication and Modification of Wladimirow-Mikulicz Resection of the Ankle.** By Dr. ALFONS NICHE (Breslau). Since its first introduction, the Wladimirow-Mikulicz operation has been growing in favor. Over 100 successful cases have already been reported. It has been done for caries, trauma, malignant disease, badly-healed fractures, shortening of the limb, and paralysis with drop-foot. The author reports a case of extensive ulceration of the lower posterior part of the leg with ankylosis of the ankle in which he cut out the ulcer, resected the tarsus according to Wladimirow-Mikulicz, and covered the site of the ulcer with the skin of the heel. The result was satisfactory.—*Archiv für klinische Chirurgie*, Band XLIX, Heft 1.

**IV. Bloodless Reduction of Congenital Dislocations of the Hip.** By Dr. JOHN MIKULICZ (Breslau). The frequent bloody operations for congenital dislocation of the hip have at least made us familiar with the anatomy of those parts. The marked changes found in adults are not seen in children. The head of the femur is at first of normal size and form, but consequently becomes flattened by pressure on the ilium. The acetabulum is likewise of normal size and large enough to retain the head, but in later years it becomes a shallow depression. The neck is also nearly normal, although in later years it becomes short and horizontal or directed downward. The capsule is large and roomy, but later it becomes contracted in the centre like an hour-glass. The ligamentum teres is either absent or much thickened and elongated. The parts are all nearly normal and there is no obstacle in the way of reduction. The head of the femur is in the capsule, and when replaced fits accurately into the acetabulum.

The author agrees with Schede, who declares that if the children have not walked, he almost always succeeds in bringing the head into the acetabulum by traction and abduction of the leg.

The chief difficulties in the way of reduction are,—

(1) Shortening or retraction of the muscles. This is overcome by tenotomy by Hoffa and others, but can equally well be brought about by weight extension if the subject be young.

(2) The capsule may be shrunken in the middle or the opening of the acetabulum may be too small. Both of these difficulties can be overcome by continuous firm pressure applied over the trochanters.

(3) Difference in size between the head and the acetabulum. In this condition, continuous firm pressure will cause the structures to adapt themselves to one another.

(4) Hypertrophy of the ligamentum teres. This difficulty can also be overcome by continuous firm pressure.

In constructing an apparatus for these cases three essentials must be kept in view: extension, abduction, and outward rotation; Schede's method is essentially as follows: weight extension by night and an apparatus by day which holds the leg abducted and presses the head against the acetabulum. The patient should not be allowed to walk.

The author has constructed an apparatus which fulfils all the indications very satisfactorily. It consists of two boards together, about as wide as the bed, which extend from the buttocks of the patient to near the foot of the bed. They are united above, but the lower ends can be separated. When the legs are attached to these boards, they may be abducted by separating the lower ends. Each board is provided with a movable trough sliding in a groove, to which weight extension may be attached. The troughs are so arranged that they can rotate on their long axis. When the legs are strapped into these troughs any degree of extension, abduction, and outward rotation may be brought about by adjusting the apparatus. At the top of the boards is a block which fits into the perineum, preventing the weight from pulling the patient down onto the board.

The patients should not be kept in the apparatus all the time.

Ten or twelve hours a day are sufficient. During the rest of the time they should wear a corset constructed to keep up some pressure on the trochanters.

The patients should be accustomed to the apparatus by keeping them in it for only a short time at first. The maximum rotation, extension, and abduction must be brought about gradually during three months.

Among five cases treated by this method, three were entirely cured in twelve, seventeen, and eighteen months respectively. The head was fixed in the acetabulum and the gait was normal. Their ages were one, three and a half, and four and a half years respectively. The other two cases were improved but not cured. Eleven cases are now under treatment.

As compared with the bloody operation, the results are very satisfactory, for a large number of cases operated upon are not cured, but go about limping after the operation, and others are made worse.

Whatever the relative merits of the two methods of treatment may be, one would not be justified in operating until after the bloodless method had been given a thorough trial.—*Archiv für klinische Chirurgie*, Band XLIX, Heft 2.

GEORGE R. WHITE (New York).

# REVIEWS OF BOOKS.

EARLY SCOLIOSIS, OR CURABLE CURVATURES OF THE SPINE. By PERCY G. LEWIS. London: John Bale & Sons, 1895.

This little book, after dealing briefly with the anatomy of scoliosis, takes up the diagnosis, symptoms, and treatment of curvature. The methods of treatment are confined chiefly to the use of the simple exercises by which the deformity is corrected and the defective muscles improved.

It is a good guide to the systematic treatment of these mild cases of lateral curvature of the spine.

SKIASCOPY AND ITS PRACTICAL APPLICATION TO THE STUDY OF REFRACTION. By EDWARD JACKSON, A.M., M.D. Philadelphia: Edwards & Docker Co., 1895.

The object of this book is to give a clear and practical account of the value and use of the shadow-test in measuring refraction, and to bring about a more general adoption of skiascopy as an essential part of the examination for ametropia.

One of the great advantages claimed by the author for this test is that it is objective and independent of the patient's intelligence or visual acuteness, and, more largely than any other, independent of the patient's co-operation.

The book is well written and illustrated with original drawings.

JAMES P. WARBASSE.

# THE ETIOLOGY, DIAGNOSIS, AND TREATMENT OF MALIGNANT DISEASE.[1]

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IN assuming the office of the presidency, it becomes my first and pleasing duty to cordially thank the members of this association for the great honor which they have seen fit to confer upon me. It will be my aim to make this meeting a memorable one in the history of the association. The records, the discussions, and the clinical work of this organization are well known throughout the civilized world. It is, therefore, with a keen feeling of inability to instruct so many eminent men that I approach my task with much hesitation. The great prominence which the council has given this year to a discussion of the results of treatment in malignant disease has directed my attention to this subject.

In the busy pursuits of our professional work tangible results are desired. The days for speculation in fanciful theories are past, and every worker in this society believes that practical results, which can only be obtained by careful analysis and scientific study, are the only reliable helps to guide us in our search after the truth.

I have selected, therefore, a subject for discussion upon which I possess reliable and accurate data. It is a subject, too, which has never been considered in the manner in which I shall present it to you upon this occasion, and, furthermore, it is a subject the materials of which have involved many years of study and observation.

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[1] The Presidential address delivered at the opening of the session of the American Surgical Association, of 1895.

With this brief introduction, I shall invite your attention to some clinical remarks upon malignant tumors, including a report of a series of cases which have been cured beyond the three years' limit of time, and, therefore, in all probability permanently cured, since the likelihood of return after three years' duration is infinitesimally small.

Great diversity of opinion has existed during the past few years as to the question of the curability of malignant disease. Writers upon this subject have presented a melancholy picture. Statistics have been published from time to time embracing a series of cases of carcinoma, for example; but the collection of a group of malignant tumors in which are included every kind, and affecting any structure or organ and applying a three years' limit of immunity, has never been systematically made. It matters little whether a patient has a carcinoma or sarcoma, or any other form of malignant neoplasm, the chief object of interest to him or to her is the possibility of rescue. If it can be shown that patients suffering from malignant disease can be cured by surgical interference, and at the same time the conditions necessary to effect a cure can be pointed out, brilliant results may be confidently expected in the future.

The chief difficulty in obtaining reliable statistics upon the question of permanent cures in the treatment of malignant disease lies in the fact that surgeons report cases of cure in tumors which were in reality non-malignant. In order to overcome this difficulty there should be a rule from which there is no exception. Before a tumor is classed malignant, it must be subjected to a thorough microscopical examination by a well-recognized pathologist. If this condition is not complied with the case should not be included in the list of cures. I have had many cases of malignant disease in which there was no doubt in my own mind, both from the clinical as well as from the gross appearances, yet these cases have been excluded in estimating the curability of malignant disease because a microscopical examination was wanting.

The first thing that impresses one in the study of this subject is that there are certain recognized *conditions* which give rise to malignant disease. The second thing is that apparently these same conditions exist without giving rise to malignant disease. It is, therefore, most difficult to understand why in the *one* case a carcinoma or a sarcoma develops, and in *another* case under apparently similar conditions no carcinoma or sarcoma develops. The same law which governs infection in zymotic disease is, without doubt, in operation in regard to infection in malignant disease; but the full interpretation of that law has not yet been made. The germ theory of malignant disease has not been proved to the satisfaction of the surgeon; but without doubt in due course of time light upon this important point will appear. In the present unsettled state of opinion, it is incumbent upon the surgeon to direct his attention to the *clinical* part of the question and to leave the bacteriological controversy to that domain of science. At all events, the clinical side of the question will eventually be found to harmonize with the bacteriological, and it is by pursuing the subject along these lines that an ultimate conclusion will be reached. Death is the inevitable result of malignant disease unless it is removed, and, since every one is exposed to conditions giving rise to malignant growth, it is important to inquire into the special circumstances connected with the growth and development of malignant tumors.

In presenting these cases for discussion, I do not wish it to be understood that in each case the cause which has been assigned was the *only* cause present to produce the disease.

For many years I have given the closest clinical observation to a study of the causes which give rise to the development of malignant tumors, and have read with unusual interest the discussion upon the bacteriological origin of tumors. At the present time the weight of opinion seems to be opposed to the germ theory. Clinical evidence seems to point strongly in favor of the view that changes of an inflammatory nature are responsible for the development of malignant tumors. The prominent fact is brought out in connection with a clinical study of the etiology of tumors that mechanical injury is associated with sarcoma, notably of bone; that peripheral irritation in connection with carcinoma, notably of organs and soft tissues.

Let us now examine into some cases to demonstrate the truth of the above statements. The following cases serve to illustrate the etiology of malignant tumors from *mechanical* injury:

CASE I.—I. T., aged thirty-six years, in August, 1883, was thrown from the end of a platform-car and was caught upon an iron upright, from which he was held suspended. An examination of the injured limb revealed the presence of a fracture of the lower end of the femur. Although every precaution was taken to repair the fracture, it failed to unite in the usual time. From the seat of the injury a subperiosteal sarcoma developed. In May, 1884, I amputated the limb at the hip-joint. This was just nine months from the time of the fracture.

CASE II.—J. H., aged four years, in February, 1881, received an injury to the fibula from which developed in three months a round-celled sarcoma. I amputated the limb just above the knee-joint. The patient is to-day well and with no evidence of return.

CASE III.—J. F., aged nine years, in April, 1887, received a severe blow upon the tibia, and a swelling appeared at once. In three months a tumor developed at the site of the original injury. The growth proved to be a central sarcoma of the tibia.

CASE IV.—J. N., aged sixty years, a school-teacher, in January, 1888, struck his leg violently against a school-bench, and a swelling appeared at once at the seat of injury. This tumor grew slowly, and proved to be a subperiosteal sarcoma of the tibia. In six months from the date of the injury I amputated the thigh.

CASE V.—F. F., aged ten years, in February, 1889, was struck upon the tibia by a stone. A swelling appeared, and within six months a tumor developed at the seat of the original swelling. The examination was made by Dr. Dunham while the patient was under the influence of ether, and amputation was performed as soon as the microscopical examination was announced to be subperiosteal sarcoma.

CASE VI.—M. G., aged twelve years, fell upon the back of her head while exercising upon roller skates. She struck upon the occipital bone, and a hæmatoma quickly developed. In six months following the accident a huge sarcoma developed, causing total blindness and death. The autopsy was performed by Dr. McNamara, who found a linear fracture of the skull, at the seat of which the sarcoma developed.

Case VII.—Miss D., aged sixteen years, struck the back of her hand while exercising in the gymnasium. Over the site of injury a swelling immediately developed. The tumor was painful and grew very rapidly. I amputated the forearm, and the patient is perfectly well at the present time. A noteworthy clinical fact in connection with this case is the simultaneous development of a tubercular abscess in the hip-joint, which a week after the amputation of the forearm was opened and drained. I have seen also a second case of tubercular joint abscess in connection with sarcoma.

Case VIII.—S. H., aged sixty-four years, struck his ilium against a desk. The pain and swelling were slight at first, but soon both became well marked. There was considerable pain upon movement of the back. Difficulty gradually increased, and soon he was unable to walk. Five months after the original injury I saw this patient with the late Dr. Sands, who confirmed the diagnosis of sarcoma. Patient died in about eleven months from the receipt of the injury, and the tumor was examined and proved to be sarcoma.

Case IX.—A. T., aged twenty-four years, struck his thigh upon a piece of machinery. The force was considerable, and a periostitis developed over the site of the trauma of the bone. The swelling began to affect the shaft of the bone, but not the epiphysis. Amputation was performed at the hip-joint, from which the patient recovered, and at the expiration of four years was living with no evidences of return. The development of the sarcoma from the bone which had been injured and which had been the seat of a periostitis was most significant.

From a large number these nine cases have been selected to illustrate the etiology of sarcoma from traumatism. They have all a clear and unmistakable history of direct injury to the bone. In each case the original swelling was the seat of the malignant tumor, and with two exceptions within six months from the time of the injury. In each case a microscopical examination was made by a skilled microscopist, and in each case the tumor is presented with a microscopic slide. Admitting that the diagnosis was beyond doubt, and the history of the injury was based upon reliable information, the interesting question arises as to whether there is a direct relationship between the cause and the effect. It is not so difficult to understand that the injury acted as a predisposing cause to develop the sarcoma in each of these individual cases, as it is to explain the cause of the disease when it appears simultaneously in different parts of the body. In cases of multiple sarcoma it is a question whether there is a constitutional cause which gives rise to the growths, or whether infection spreads from a primary local centre. "Multiplicity of growth is not a proof of generalization of growth," and in the cases of multiple sarcoma there must be a primary local infection from which rapid dissemination of the disease takes place by the blood-vessels.

In one case of sarcoma of the thigh in which I amputated at the hip-joint there was immunity from the disease for six months. The disease returned in the forearm and spread rapidly, so that in twenty-four hours a tumor would actually develop. There was no return in the stump at the hip-joint, but in every organ and in almost every bone in the body sarcomatous infiltration occurred. If a sarcoma will grow in a few hours, is it not possible that from a local infection the multiple growths may derive their origin?

These nine cases of authentic history and certain diagnosis reveal evidence of a very strong nature in favor of the inflammatory origin of sarcoma. The proof is not so clear as regards carcinoma, but I will briefly cite a few cases to illustrate the probabilities that irritation is at least a predisposing cause to develop carcinoma.

The following cases serve to illustrate the etiology of malignant tumors and peripheral irritation:

Case I.—Mrs. J., aged forty-six years, in May, 1881, gave birth to a living child during the seventh month of pregnancy. The child died, and the mother's breast filled with milk. The glands, however, very soon ceased to secrete milk. Two months later a small piece of skin became loose upon the top of the nipple; this scale of skin separated, and the surface underneath became irritated. A slight discharge followed, accompanied by a disagreeable itching sensation. This eczema continued for many months, and finally a lump appeared behind the eczematous nipple. I removed the breast with the tumor, which proved to be epithelioma. The disease returned in the cicatrix, and for a period of three years no less than eight operations were performed. The disease was finally arrested in the breast, and the return of the disease occurred in the brain, from which the patient died, eight years from the first appearance of the eczema.

I have seen two other cases of eczema of the nipple in which epithelioma followed. There is no doubt that the eczema seen in these cases is different from a simple eczema observed in other parts, since the usual conditions are absent, such as irritable and dry skin, overwork, anxiety, faulty innervation, nerve disorders in vessels and tissues, the uric or gouty diathesis, deficient kidney action, biliary exudation, and dyspepsia. It is also found where there is no friction and moisture, another condition so likely to develop ordinary eczema, illustrations of which are observed in the groin and perineum. Again, "Paget's disease of the nipple" is seen without the presence of any disorder of the internal organs, such as albuminuria, glycosuria, gout, and icterus. Finally, this disease does not disappear by the use of those means by which simple eczema is relieved. This eczema is a local affection at first, and by its continued irritation causes epithelial proliferation in the lactiferous ducts.

The eczema is at first a chronic affection of the skin about the nipple and the areola, and never extends deep into the tissues, since the erosion is superficial. This form of eczema occurring in women who have passed the climacteric is very likely to give rise to epithelioma, and there is no reason to suppose that the eczema is secondary to breast epithelioma, since the eczema antedates any signs of epithelioma in the ducts.

Case IV.—Mrs. C., aged forty-seven years, was sent to me from Portland, Oregon. She suffered from an ulcer in the mouth, accompanied by enlargement of the submaxillary and sublingual glands. A microscopical examination showed the growth to be epithelioma. The patient had worn a red rubber plate of false teeth for many months. I removed the epithelioma, together with the gland.

The question which arises in reference to this case, as in other similar ones, is, Did the red rubber plate have anything to do with the development of epithelioma of the mouth? Red rubber contains vermilion. In an ordinary plate, which weighs about 288 grains, there are ninety-six grains of sulphuret of mercury. In other words, a patient wearing a red rubber plate carries in the mouth ninety-six grains of sulphuret of mercury, about two grains of which are in direct contact with the mucous membrane of the mouth ; but such sulphuret of mercury is insoluble in water, though it may eventually be converted into a soluble salt by the constituents of saliva. In consequence of this increased action of the superficial vessels, an inflammation of the mucous membrane must necessarily follow.

It is certain that the mercury in the red rubber must be a source of irritation to the mucous membrane of the mouth, and for this reason alone either a gold or aluminium plate should be substituted. In addition to the fact that red rubber contains mercury, it is also a non-conductor of heat and cold. This is an additional cause of irritation to the delicate mucous membrane of the mouth, just as a rubber shoe affects the foot. The membrane is irritated and scalded by constant presence of the red rubber plate, and while it is not a cause of epithelioma, yet this material produces a long-continued irritation, which devitalizes and deteriorates the tissues, and thus renders a soil favorable by malnutrition and by lowered vitality to the development of cancer. At all events, I have never seen epithelioma develop in the mouth of a patient who uses a gold plate, and, after careful inquiry, I have been unable to find any dentist who has seen the disease under these circumstances.

CASE V.—Mrs. O., aged thirty-six years, in May, 1890, consulted me in reference to an ulcer upon her arm. She was burned when a child, and a considerable amount of cicatricial tissue was formed. At one point the scar was very tense, and at this place an ulcer developed which proved to be epithelioma. Here, again, is a tissue of low vitality continually irritated by traction and an epithelioma develops. I have also seen malignant disease arise in the cicatrix of a gunshot wound upon the face under similar conditions. These two cases illustrate the law that in poorly-nourished tissues malignant disease is likely to occur, especially when there is present a continual source of irritation.

Case VIII.—Mr. T., aged sixty-five years, in May, 1890, consulted me on account of an ulcer situated upon the inner side of the cheek. The ulcer was microscopically examined and proved to be epithelioma. Patient states that for forty years he has carried a quid of tobacco in that spot. The irritating influences of the nicotine caused the tissues to be altered from their normal standard, and thus made a favorable nidus for infection. I have notes of three other cases in which epithelioma developed under precisely these same conditions. Here, again, in these four cases tobacco was not the cause *per se* of the epithelial cancer; but the irritation produced by the continual presence of nicotine predisposed the tissues, by lowering their vitality, to become infected.

Nicotine is, without doubt, a source of irritation to mucous surfaces. So great is the absorption of it by a mucous surface that one single drop placed upon the tongue of a cat prostrated the animal at once, and in less than eighty seconds destroyed life. There are about 331 grains of nicotine in a pound of tobacco, and five milligrammes will poison a dog in three minutes; one-eighth of a grain dropped upon the conjunctiva of a cat causes contraction of the pupil. Thus it is evident that a poison so virulent and so rapidly absorbed cannot but have an injurious effect upon the mucous membrane of the mouth, and these cases of epithelioma starting from the part of the buccal cavity in which tobacco is continually held is certainly a most significant fact. While a student in Langenbeck's clinic, in Berlin, I saw several cases of epithelioma of the cheek, and to this condition the term "American disease" was applied, because it was chiefly seen in Germany in those who chewed tobacco.

Another illustration of the law that continuous and unnatural irritation in the mouth is likely to cause epithelioma is found in the malignant growths affecting the tongue of those who nail laths. It is a custom with these mechanics to introduce into the mouth lath-nails and to push them out by the tip of the tongue as fast as they can be used. An expert will take into his mouth and push out of it with the tip of the tongue, at a low estimate, several thousand nails per diem. This irritation continued day after day has been followed by cancer. Recently two other cases of this kind have come under my personal observation. Here, again, I do not believe that the contact of the nails with the tongue directly caused the cancer; but the continued irritation lowered the vitality of the soft parts so as to render the tissues susceptible to infection. Other illustrations of this law, that continued and unnatural irritation is likely to predispose the tissues to infection, is seen in the irritation produced by soot in chimney-sweep's cancer, also in the irritation produced by a clay pipe, which by its adhesive qualities tears off from time to time the thin cuticle from the lip; and, again, by the irritation caused by the continual pressure of the spring of a pair of eye-glasses, two illustrations of which have recently come under my notice.

The cases reported by Dr. Gerster of epithelioma of the rectum in patients who were in the habit of using the nozzle of an injection syringe in such a manner as to daily bruise or lacerate the mucous membrane of the rectum, is another illustration of the same law. The lacerated cervix is still another good example of irritation in poorly nourished tissues causing epithelioma. Still another illustration is seen in epithelioma from a chronic ulcer of the leg.

The following cases serve to illustrate the etiology of malignant tumors from *sinus irritation:*

Case XV.—Mrs. E. P., aged forty-eight years, in May, 1886, sustained a compound fracture of the tibia. The bone united, but a limited area of necrosis followed. From the superficial surface of the limb a small sinus led down to the necrosed bone. This sinus was lined with a pyogenic membrane and discharged thin ichorous pus. After many months a typical epithelioma developed at the mouth of the sinus. The tumor was examined microscopically and found to be epithelioma.

This case is a good illustration of the law that a discharging sinus is a source of great danger to the patient, since the continual irritation induced by the acrid pus led to the development of true epithelioma. The case shows the great danger of allowing a sinus to remain without performing an operation for its radical cure.

Case XVI.—J. T., aged forty years, in 1880 was shot in the shoulder-joint; the wound healed, leaving a small sinus which led down into the joint. The sinus remained open for many months, and at its mouth a typical epithelioma developed. The causes in this case which produced the epithelioma are identical with those just mentioned in the preceding case, and further serve to emphasize the dangers that attend a sinus which is left by the surgeon unhealed.

To reiterate what has been already said, these nine cases of sarcoma serve to forcibly illustrate the law that sarcoma of the bone is associated with injury, but that every injury of bone is not followed by sarcoma. These sixteen cases of cancer serve also to illustrate the law that this disease is associated with irritation, but that every irritation is not followed by carcinoma. The same law is present in epithelioma of the alimentary canal, since cancer is usually found in those places where there is a constriction, as in the lips, pyloric end of the stomach, ileo-cæcal valve, and rectum. In other words, there must be present a predisposition in order to develop the disease. Finally, these cases of cancer which were developed from sinus irritation and from indolent ulcers point to the same etiological law.

The question as to the etiology of tumors has been greatly simplified within the past few years, since pathologists have been able to exclude many growths that were formerly considered under the head of tumors. These growths are now included under infections. Among this group may be mentioned granuloma, tubercle, leprosy, gumma, glanders, and actinomycosis. Hydatid cysts have been eliminated from the original group of tumors, so that in reality a tumor has at the present day a most restricted meaning.

The theory of Cohnheim, that tumors arise from proliferation of embryonic cells which were displaced during fœtal life and which rapidly multiply in consequence of some exciting cause, cannot be rejected. Any attempt to explain tumor-formation except from vestiges and rests seems futile.

The theory of parasitic origin of certain tumors has been brought into prominence of late. The demodex in the skin and the coccidium in the intestine are examples illustrating the parasitic causes of tumors. In support of the parasitic origin of cancer, it is maintained that the germs gain admittance into those glands which are in direct communication with the external atmosphere or through the medium of the intestinal gases. The mammary glands, the stomach, and rectum are the organs most frequently infected by cancer, and the entrance of the parasites is explained in the manner just described.

The frequency of epithelioma of the cervix as contrasted with the rarity of this disease affecting the uterus; the infrequency of epithelioma affecting the prostate as compared with the prepuce; the frequency of the disease affecting the lips as compared with the œsophags, uare among the illustrations in support of the parasitic origin of cancer.

Among recent writers there has been a tendency to disregard the influence of injury in the development of tumors; but these twenty-five or more cases already mentioned in this paper seem to point strongly to the view that sarcoma at least is the result of cell changes due to some kind of inflammation induced by injury, and that cancer in all probability is likewise the result of some peculiar inflammation produced by continual irritation. The clinical evidence is such that the surgeon cannot disregard the strong arguments in favor of the reversion to primary cells, and if this theory is accepted the local origin of tumors seems evident. The general infection spreads from a local one, and the early and radical removal of the primary focus ought to prevent the widespread dissemination of malignant disease. As a matter of fact, the results which will presently be given seem to point to the conclusion that malignant disease is at the outset the result of local infection, and the early and complete removal of it will bring about a permanent cure.

From a careful clinical study of these cases of malignant tumors, there are some lessons which should be forcibly impressed. The first is that injury or irritation apparently is concerned in the development of malignant disease; whether these agents act as predisposing or exciting causes time only will determine. The second lesson is that all traumatisms of bone should be treated upon sound principles of surgery. The third lesson is that every unnatural irritation affecting integument or mucous membrane should be removed. In fact, the writer would go even further, and strongly recommend the removal of moles, especially those in which hairs are embedded, since these foci are often the starting-points of malignant ulcers. I have removed a large number of these moles, and in many of them a true sarcomatous structure has been found. I have here for examination a beautiful specimen of a mole apparently innocent from a clinical point of view, but which has pathologically undergone sarcomatous degeneration. It was removed for cosmetic effects, and was not considered malignant at the time.

Papillomata and warts and localized scales of psoriasis, with no tendency to heal, should be removed. The retained testicle in the inguinal canal is also another condition giving rise to degeneration which leads to true epithelioma.

These clinical facts, thus cursorily reviewed, seem to present certain questions for discussion.

(1) Has traumatism or irritation anything to do with the etiology of malignant tumors?

(2) If so, what is the relation which the cause bears to the effect?

(3) If not, how can the cases which have been reported in this paper be explained?

(4) If it is admitted that traumatism or irritation, separately or together, bear etiological relations to these tumors, how can the presence of these malignant tumors in the absence of these agencies be explained?

(5) If the theory that traumatism or irritation can develop a malignant tumor, does not the acceptance of that theory demonstrate the purely local origin of these neoplasms?

(6) Do not the cases operated upon early demonstrate the correctness of the theory that by the removal of the local infection constitutional infection can be avoided?

The *diagnosis* of malignant disease is at the present time the most important part of our subject. When the knowledge is obtained in regard to the cause and prevention of malignant disease, the second part of our subject, which involves the diagnosis, will have little interest in our discussions. In the present state of our knowledge, however, diagnosis and treatment are subjects of transcendent importance because the surgeon is confronted upon every side by the presence of malignant disease. Delay at arriving at a positive diagnosis of malignant disease is equivalent in most cases to death. The earlier a positive decision is arrived at the more certain are the prospects of cure. To this proposition all will assent; but the great difficulty which confronts the surgeon is, how can an early diagnosis be made? The duration of the growth or its rapidity are important points; but they are not always to be relied upon as infallible. For example, the writer has observed several cases of the most malignant variety of sarcoma, which, on account of the anatomical position or owing to the presence of a dense capsule, remained dormant and innocent for many years. One sarcoma of the neck, the most malignant in the list, remained in quiescence for a period of twelve years, though it had assumed the size of an orange. Complete and permanent recovery followed the operation for its removal.

Time of duration and rapidity of growth, therefore, while usually affording strong evidence in favor of malignancy, may, on the other hand, mislead in exceptional cases. Besides these two clinical facts, the age of the patient must always be considered in arriving at an early diagnosis of malignancy. As a rule, to which, of course, there are notable exceptions, carcinoma is not likely to appear before forty-five years of age. I have seen, however, cancer in a young child, and have operated on a patient over eighty years on account of the same disease; but these are to be considered as surgical curiosities.

In regard to sarcoma, the line of demarcation is not so clearly drawn. It may be said, with a fair degree of accuracy, that sarcoma appears under forty-five years of age, and that sarcoma is the characteristic malignant tumor of early life.

A certain value can also be attached to heredity. In a general summary of all cases reported upon statistics show that about 4 per cent. of the cases of malignant disease are associated with a history of heredity.

The seat of malignant tumors furnishes some knowledge as to the character of the neoplasm. For example, the primary malignant disease of bone is sarcoma, since carcinoma rarely, if ever, affects bone except as a secondary deposit. Hence, any primary malignant disease of the osseous tissue is presumably sarcoma, while, if secondary, it is in all probability carcinoma. The gross appearance of malignant tumors is characteristic. The dusky hue to the skin, the dilatation of veins over the surface, the great tendency to ulceration, the subcutaneous hemorrhagic extravasation, are points seldom seen in any other tumors except the malignant.

*The consistence of a growth and the local temperature* are important factors in arriving at an early diagnosis. Malignant tumors, as a rule, are firm and hard unless the growth is cystic, in which case the fluid is generally bloody and gives to the tumor a sense of fluctuation. The temperature of the part is not elevated unless there is superinduced some acute inflammatory attack. Abscesses, on the other hand, are attended by elevation of temperature, which is most striking as compared with malignant tumors. In abscess there is also pyrexia and a zone of induration which are characteristic.

*The presence of pain and cachexia* are also important points in connection with the early diagnosis of malignant disease. It is not only the presence of pain, but the character of the pain that must be noted. With the exception of the colloid variety of cancer, pain is present in all varieties of malignant disease. As colloid cancer is seldom situated at points amenable to surgical operation, this exception is one that is easily remembered. On the other hand, pain is absent from benign growths unless some inflammatory process has become associated with the neoplasm, and under these circumstances the pain is readily explained. Pain may also be present in a benign tumor if the nerve is included in the tumor.

It follows, therefore, that the presence of pain is of diagnostic value. In regard to the character of the pain there are some points to consider: in malignant disease the pain is not continuous; but intermittent. It is also sharp, lancinating, and darting, and it becomes more severe as the tumor develops. Finally, the pain is not increased by the manipulation of the tumor itself by the surgeon.

The cachexia of malignant disease is uniformly present sooner or later, but it is a symptom observed late in the history of the disease, and it is only in exceptional cases that its presence is of any early diagnostic value. In certain very rapidly developing growths the cachexia may appear as one of the early symptoms, but it is not a condition that affords any early information to the surgeon, no matter how soon it may appear, because its presence at any time indicates that the growth has advanced a long way in its local history.

*Information derived from the harpoon* is the most valuable, since it is positive. This method of diagnosticating the character of any tumor is applicable to all growths situated outside of the great cavities of the body. In exceptional cases, however, this method of early diagnosis can be employed in certain growths having their origin from the interior of the body. The method consists in thrusting a small needle protected by a canula into the interior of the tumor, and then by a rotary movement of the needle to entangle some of the tissue into the point, which is made like a harpoon. The tissue can then be examined microscopically and a positive diagnosis established. The surgeon must bear in mind that this trivial operation may occasionally excite inflammatory action in the tumor.

The *prognosis* in malignant disease depends upon many factors. It consequently has many variations. I am a firm believer in the local origin of all malignant neoplasms, although there are exceptional cases in which, I frankly admit, my belief is shaken, but only because I fail to find the exciting cause. From the local infection the disease may become constitutional. It is only when a malignant tumor is considered as a local infection that any hope can be entertained as to a complete cure. In the first list of cases reported where mechanical injury was pointed out as the etiological factor in the production of sarcoma, the prognosis depended upon early recognition of the disease and a prompt operation at a point far distant from the seat of the growth.

In the cases of Paget's disease of the nipple, the eczema should be treated at once according to the principles of antiseptic surgery. The earlier the treatment is adopted and the efficiency of the means employed determine the prognosis.

The question which most influences the prognosis in this form of malignant disease is whether the entire breast should be excised or only a portion of it, including, of course, the nipple. I am aware that surgeons advocate the latter operation, but at the same time they insist upon carefully watching the breast from time to time with a view to repeating the operation of partial excision if occasion arises, or at any subsequent period of removing the entire gland.

It is claimed that the primary removal of the breast is too serious an operation on account of an eczema possessing the characteristic features that have been described. I feel very certain that a radical operation is indicated in Paget's disease of the nipple, because it invariably leads to true epithelioma if not arrested, and a study of the cases of epithelioma from a clinical point of view demonstrates clearly the fact that it is a disease that is too dangerous to be left to partial excision. The prognosis in this affection depends upon the complete removal of the entire breast and even the pectoral fascia and the lymphatics, extending into the axilla. Any operation of less magnitude is not sufficiently radical to render the patient safe. I have found in a study of these cases that failure to remove the entire gland was soon followed by a recurrence, the prevention of which might have been averted by a thoroughly radical operation at the start. The comparative safety of removal of the breast is an argument strongly in favor of its adoption in these cases, and the prognosis in Paget's disease depends upon the question of complete or partial excision of the breast.

If the mortality of the two operations be compared,—viz., entire removal of the breast and a partial excision of the gland,—the difference will hardly be appreciable; but the question of return after the two operations is so different that the wisdom of the radical operation is apparent. The removal of the pectoral fascia occupies but a few seconds and does not add to the severity of the operation; but inasmuch as the fascia itself is often the seat of infection, and this, too, when unrecognized by the naked eye, but proved by microscopical examination, it seems wise to remove this possible source of infection. The lymphatics can easily be dissected up and torn carefully away by leaving the axillary angle of the gland intact until the end of the operation. This makes the prospects of the patient most favorable; anything less renders the prognosis extremely doubtful.

These are the means at the surgeon's command to early diagnosticate and to prognosticate in malignant tumors. The application of these fixed principles explain the reasons which influenced largely the success in arriving at the results to be presently recorded.

The next thing that has materially aided in bringing about these results has been the execution of a thoroughly radical operation. This brings us to the third part of our subject,—viz., the *treatment* of malignant disease.

For many years the writer has been collecting data for the purpose of arriving at some conclusion as to the value of operative interference. Every case has a carefully prepared history, which was taken at the time of the operation. Every specimen has been thoroughly examined by a well-known microscopist. Each tumor is preserved as well as a slide from the original growth itself. The histories, the slides, the original tumors are all here for examination, and at the clinic I shall exhibit some of the patients. The names of the surgeons who were present at each operation are also recorded. Finally, no patient is admitted in the list whose cure has not been at least for three full years, and whose complete history from the beginning down to the present time is not known. The amount of labor necessary to keep these records complete for so many years can hardly be estimated. The writer desires in this connection to urge upon the members of the association the great importance of keeping the histories, the microscopical examinations, the tumors, as well as a record of the patient's welfare from time to time. Unless this is done, no reliable information upon which to base statistics can be obtained. When this information is furnished, surgeons can very soon arrive at some positive knowledge in regard to the prognosis in the treatment of malignant disease. The writer with great humility presents these facts, since he hesitates to review the valuable work of surgeons whose reputation, skill, and knowledge are of world-wide repute.

To pass in review the work of Butlin, Williams, and Gross, not omitting the individual members of this distinguished association, is a task which any surgeon might assume with a deep sense of responsibility.

This contribution, therefore, is offered only with a desire to search after the truth. The writer also in presenting these carefully prepared facts disclaims any personal superiority in regard to operative technique, and frankly admits that certain fortuitous circumstances have attended his labors. How, then, are these results to be explained? Why are they so much better than those which have been hitherto published? What course should a surgeon take to insure the same or better results? These questions teem with profound interest to every practical surgeon. They are questions, too, that vitally concern each one of us, because the next victim to fall may be in our own circle. The medical man as well as the laity is deeply and practically concerned in these momentous issues.

The term radical treatment is susceptible of a wide range of meaning, since a radical operation to some is to others an inadequate one. An amputation may be considered radical and yet at the same time be insufficient. A sarcoma of the external malleolus requires more than amputation of the leg, since the popliteal glands are often very early affected, and, therefore, amputation of the leg is clearly inadequate. In a case of sarcoma of the external malleolus the writer has performed an amputation above the condyles of the femur. This great sacrifice was made for the express purpose of not only removing the entire bone affected, but also to insure complete extirpation of the popliteal glands. Ten years ago I adopted this method in a case of round-celled sarcoma of the external malleolus. The tumor was examined by Professor Welch, of the Johns Hopkins University, and pronounced by him as most malignant. The young man is alive and well to-day, and the tumor is here for inspection and microscopical examination.

Recently I have seen a case in which, six months ago, a surgeon excised a sarcoma from the lower end of the fibula. At the present time a large sarcoma is situated at the site of the original small tumor, and the popliteal glands are enormously enlarged, and the disease has even invaded the inguinal glands. In this case, an exact counterpart of the one just referred to, it is nearly certain that early amputation just above the condyle would have prevented a local and a regionary recurrence and death itself, for this is inevitable within a few months from now, or within a year from the time of the first inadequate operation. It may seem absurd to sacrifice so much of the body for so insignificant a growth, yet clinical history repeats itself over and over again that death is the alternative unless radical operation is boldly resorted to as a curative measure.

In performing a so-called radical operation for the removal of malignant disease, it is often a question as to how much glandular tissue it is necessary to dissect out from the adjacent tissues, and especially what particular glands require removal. In certain cases it is wholly unnecessary to extirpate some near-lying and large glands and omit the small chain of lymphatics which shoot off directly from the infected area. In epithelioma of the lip there is situated near the angle of the jaw a gland which is in connection with the labial glands. This small gland should be dissected out even though the larger and submaxillary gland beneath the jaw is apparently free from infection. The neglect to do this is often the cause of a recurrence of the cancer of the lip, even though the submaxillary gland has been extirpated. At my suggestion, Professor Gerrish has made a unique and beautiful set of plates for an article on the surgery of the lymphatic system, in which is shown the direct line of infection from any given point in the body. An examination of this chart at once reveals the points of attack that the surgeon should make after the removal of the malignant neoplasm has been effected.

At this juncture another question arises of great importance. If a radical operation is performed and recurrence takes place, is there any prospect of permanent cure by repeated operation? To this proposition I reply that operations should never be abandoned as long as the growth can be removed, provided only the metastasis has not invaded the internal organs. This suggestion has reference not only to mere prolongation of life and the amelioration of physical suffering, but it also has a direct bearing upon the ultimate and permanent cure. There are some good examples illustrating this law in some of the older works of surgery. Dr. Valentine Mott operated fifteen times in one case of sarcoma during a period stretching over twenty-three years, and Gross operated twenty-three times on a case of sarcoma covering a period of four years. The writer has removed from the same patient an axillary sarcoma, afterwards the breast, then, later, several sarcomatous glands in the inguinal region. It is now over three years since any recurrence has taken place, and the patient seems perfectly free from a return and enjoys most excellent health. A failure to operate on any of the tumors would have abandoned the patient to certain death. Repeated operation in different parts of the body has at last rescued this unfortunate patient and has placed her beyond the probable chances of death from sarcoma. In one case over two hundred individual carcinomatous tumors have been removed, and the patient is apparently free from the disease at present.

In regard to the final proposition as to the course which every surgeon should adopt to insure the best results.

The surgeon, in assuming the care of a patient with malignant disease, should apprise the friends, but not the patient, of the real dangers. It is well also to refuse to take all the steps necessary to arrive at a correct diagnosis unless assurances are given by the friends that the patient will be persuaded to abide by the result. For example, it often happens that after using the harpoon a fungous growth starts up immediately, and the patient becomes dissatisfied and abandons the surgeon to take the advice of some charlatan or quack. The harpoon should not be used unless there is a distinct understanding that if the result of the examination demonstrates the presence of malignant disease, that the permission will not be withheld to perform a radical operation.

In studying the nature and history of malignant disease, the only safety lies in early diagnosis, in a radical operation and in a repetition of the operation if necessary. The mere statement of such a proposition is of no value unless the truth of it can be proven beyond all peradventure.

The treatment of malignant disease by the injection of the toxines of erysipelas, as practised by Dr. Coley, deserves more than a passing notice. The writer would respectfully refer the members of the association to his interesting monograph upon that subject. The results of treatment by operative interference are only considered upon this occasion.

The treatment by methods based upon the same principles as are employed by Pasteur in inoculation for the cure of hydrophobia have not yet been sufficiently tested to warrant any consideration of the subject in the present paper.

In sarcoma of the *glands* statistics are very meagre. Butlin reports that he fails to discover a single case of permanent recovery after operation for the removal of sarcoma of glands.

The writer has had twelve cases of sarcoma of glands, the subsequent histories of which are all known. Recovery has occurred in every case but one, thus giving 91⅔ per cent. of permanent cures beyond the three years' limit of time. In these twelve successful and permanently cured cases of sarcoma of the glands there were some which were very large. In two the tumors involved the neck, one of which was larger than a child's head, necessitating a deep and dangerous dissection which exposed the large cervical vessels. In another case the tumor was situated about the femoral, and in another about the popliteal vessels. Some of the tumors were removed in the presence of alarming hæmorrhage, and involved a most formidable operation.

In regard to sarcoma of bone, Butlin reports 78 cases of subperiosteal sarcoma, of which the results in 28 cases are unknown, and in 6 more the patients had not reached the three years' limit of time, which leaves 44 cases in which the full subsequent histories are known. Of these 44 cases 14 died of the operation and 29 from recurrences, which leaves but one permanent cure in the 44 cases. There are thus 78 cases in which operation was performed, 14 of which died from the immediate effects of the operation, which gives 18 per cent. of mortality, and of the 44 cases whose full subsequent histories are known, there was but one permanent cure, or 2 per cent.

In periosteal round-celled sarcoma of *bone* Gross estimated the duration of life at eighteen months, and of 6 cases operated upon, only 1 remained well without local recurrence, thus giving only about 17 per cent. of permanent cures.

The writer reports 21 cases of subperiosteal sarcoma of bone in which an operation was performed, one of which, an amputation of the hip-joint, died from the immediate effects of the operation. This gives 5 per cent. mortality for the operation. The histories of 4 are unknown.

In a summary of the 17 cases of subperiosteal sarcoma in which the results are known, there are 3 deaths, 1 of which has just been referred to as a result of shock, and 14 cures beyond the three years' limit of time, which gives 82 per cent. of permanent cures. This is in marked contrast to Butlin's statistics, which record only 2 per cent.; or the more recent statistics of Gross of 17 per cent. of permanent cures.

Of central sarcoma Butlin has collected 82 cases treated by operation, of which 23 cases died from the immediate effects of the operation, thus giving a mortality of 28 per cent. Five died from recurrences; and only 10 patients were known to be alive at the end of a year, and some of the 10 after two or more years. But, of course, here there are no definite statistics.

In Warren's book on "Surgical Pathology," he reports from Gross 34 cases of central sarcoma of bone, of which 3 died without operation, and of the 31 operated upon, 5 died from the immediate effects of the operation, giving a mortality of 16 per cent. Six cases died from recurrence and 2 had not reached the three years' limit of time; there are, therefore, 18 cases still alive. Of the 31 cases operated upon 2 had not reached the three years' limit of time, which leaves 29 cases whose subsequent histories are known. Of these 18 were permanently cured, which gives us 62 per cent. The writer has had only one case of central sarcoma. This patient was operated upon and recovered and is still alive, after ten years from the date of the amputation.

Butlin describes excision for removal of sarcoma affecting bone. Such an operation is manifestly ineffectual and does not deserve a moment's consideration. In all of my 14 cases of recovery dating back over three years, the limb, with one exception, was removed so as to include the entire bone affected. Any operation short of this radical one is sure to be followed by a return. It seems a terrible sacrifice to remove the thigh at the hip-joint for a sarcoma involving the condyles, or lower third of the shaft of the thigh; or the leg above the knee-joint for a sarcoma affecting the malleolus; but these 14 cases prove the necessity, and the cases of excision or partial amputation through the bone, collected by Butlin, prove the utter uselessness of any operative measures of less radical character.

In epithelioma of the face, Butlin, from many sources, collected 206 cases. Operation was performed with 21 deaths, or a mortality of 10 per cent. There are 59 cases where subsequent histories were unknown, and of the remaining 147 cases, 25 of them had not yet reached the three years' limit of time, leaving 122 whose subsequent histories are known. Of these 21 died during treatment, and in 51 cases there was a recurrence of the disease; the remaining 50 were permanently cured. There are, therefore, 122 cases in which the history is known, of which 50 were cured, giving a percentage of permanent cures of about 41 per cent.

The writer has operated upon 8 cases of epithelioma of the face, with no mortality so far as the operation itself is concerned. In these 8 cases the subsequent histories are all known. In 1 the patient died after many local recurrences, in which more than 30 operations were performed, extending over a period of twelve years. Two died from a return of the disease within three years. The remaining 5 were permanently cured, which gives 62 per cent. of permanent recoveries. There are several cases in which recovery from the operation has taken place and in which as yet no recurrences, either local or regionary, have occurred; but these cases unfortunately have not yet reached the three years' standard, and, therefore, cannot be counted at present. There are also a large number in which the microscopical evidence is wanting, and, therefore, the cases are rejected.

In carcinoma of genitals, tongue, lips, etc., the number of each is too small upon which to base any statistics. Suffice to say, that among the cancers affecting these organs and structures there are cases of permanent cure.

Let us now turn to the consideration of the treatment of carcinoma. The necessity of an investigation of carcinoma can be estimated, when it is considered that in England alone there are 7000 deaths annually from cancer, and that there are 30,000 patients suffering at all times in that country from this affection.

The mere fact that cancer causes more deaths in the United States in one year than the sum-total of deaths due to erysipelas, tetanus, hydrophobia, lightning, typhlitis, gunshot-wounds, joint disease, together with other well-known surgical affections, conveys at once an idea of the wide dimensions of our subject. Cancer causes nearly half as many deaths in one year in the United States as are caused by accidents and injuries of all kinds and descriptions.

Dr. Billings has demonstrated by statistics that carcinoma is a disease which is slowly increasing, and that it is the cause of a larger proportion of deaths in nations which have reached the highest state of civilization. For example, in the United States in one year there were over 13,000 deaths from cancer, of which there were twice as many deaths among females as among males. There are over 14,000 people in the United States dying each year from cancer.

In cancer of the breast Halsted published a monograph in which he based his 6 per cent. of local recurrences on the 50 cases which he reported in 1894; but of these 50 cases the results of 5 he records as unknown, and 25 of them he reports not having reached the three years' limit of time. There are, therefore, only 20 cases instead of 50 that could be utilized at the time of his publication in estimating the local and regionary recurrences. In the 20 cases of which he can speak with authority, 18 of these died before the three years' limit was reached, leaving only 2 in which it can be said at the time of the publication of his paper that recovery took place according to the generally accepted standard of the three years. Halsted's figures, therefore, show 10 per cent. of permanent cures and 15 per cent. of local recurrence, since in the 20 cases there were 3 local recurrences.

Halsted has not published the work of American surgeons in his table, and there are several men in this country whose published results are much better, with one exception, than all of those recorded as the work of foreign surgeons. The high percentage of permanent cures is much more important than a low percentage of local recurrences, since the permanent cures include the regionary and local recurrences. Halsted's statement that "the efficiency of an operation is measured truer in terms of local recurrence than of ultimate cure" needs a transposition, which would read that "the efficiency of an operation is measured in terms of no mortality in the operation and permanent cure in the ultimate result."

The writer has had 116 cases of tumors of the breast, of which 19 were not operated upon, leaving 97 cases in which the breast was amputated. In the 97 cases of amputation there was but 1 death, thus giving a mortality of a little over 1 per cent. The 1 fatal case was due to the presence of hæmatophilia, and is a death that might have occurred in connection with any other operation, no matter how insignificant in character. This death can, therefore, with propriety be excluded as far as bearing upon the mortality of this special operation, and, if so, there is an unbroken series of 96 consecutive operations without a death. In addition to the reduction of the mortality of the operation from as high as 23 per cent., recorded by Billroth, to a cipher, there was no case of pyæmia, septicæmia, erysipelas, or abscess.

Of the 97 cases of amputation of the breast 23 cases of sarcoma and other tumors than cancer must be eliminated in order to compute the percentage of permanent cures of pure carcinoma of the breast. Of the 74 cases of pure carcinoma of the breast, the subsequent histories of 41 are known; 3 of these have not reached the three years' limit of time (although they are still alive and free from the disease); there remain 38 cases, therefore, of pure carcinoma of the breast in which the full subsequent histories are known. In these 38 cases there are 17 cases in which a permanent recovery has taken place. This gives 45 per cent. of permanent cures. Among these 38 cases whose histories are known there were but two local recurrences, which gives but a little over 5 per cent. of local recurrences.

Since the publication of the writer's last statistics, in 1891, he has had 15 cases of pure carcinoma of the breast, with no mortality from the operation itself. Of these 15 cases, 1 died several weeks following the operation from hæmatophilia, in which the major joints were filled with blood and the greater part of the body was affected with subcutaneous hæmorrhages. Two of the 15 cases have not yet reached the three years' limit of time. There are, therefore, 13 cases in which the full subsequent histories are known; 2 of these died from a recurrence of the disease and 1 from hæmatophilia, as stated above, and the remaining 10 have passed the three years' limit of time. This gives 77 per cent. of permanent cures in cancer of the breast in the last 15 consecutive cases.

The reason why these radical operations have not been hitherto employed in amputation of the breast lies in the fact of the mortality of the operation, since Gross reports 10 per cent. mortality; Sir Joseph Lister, 8 per cent.; Butlin, 7 per cent.; Fischer, 20 per cent.; Esmarch, 10 per cent.; Küster, 14 per cent.; Billroth, 15 per cent.; and again Billroth, in a previous list, 23 per cent. In my list of cases of amputation for all kinds of tumors of the breast, the mortality of the operation is less than 2 per cent. This mortality includes the results of radical operation. In Weir's list the mortality is reduced to zero. If this represents the mortality, there is no longer any reason for surgeons to offer the dangers of the mortality of the operation as an excuse for refusing radical operation, since it is in those cases in which a most complete operation has been performed that permanent recoveries follow.

In sarcoma of the *breast* statistics are very meagre. Butlin in his book gives no results either as to mortality or as to permanent recoveries.

Williams in his book reports 10 cases of sarcoma of the breast in which no deaths occurred in consequence of the operation itself. The subsequent histories of only 2 out of the 10 cases are known. Death occurred in the 2 cases within two years from the date of the operation. The percentage of permanent cures, therefore, amounts to zero, since no patient recovered so as to be free from the disease for a period of three years. It is to be regretted that nothing is known of the 8 cases, since among the list there may be some cases of permanent cures. It is unfortunate that these cases have been lost sight of, since no statistics of permanent cure can be recorded unless the result is known. Gross reports 91 cases operated upon, of which 12 were permanently cured, giving 13 per cent. of permanent cures.

The writer reports 6 cases of sarcoma of the breast in which no death occurred in consequence of the operation itself. The subsequent histories are all known. Four of the six cases were permanently cured and the remaining 2 cases died from a return of the disease. This gives $66\frac{2}{3}$ per cent. of permanent cures in sarcoma of the breast.

If the few suggestions which the writer has ventured to make will induce the members of the American Surgical Association to be on the alert for the early recognition of malignant disease and to employ a radical operation for its relief, and a repeated one if necessary, he will be more than repaid for the tedious labor involved in gathering together the clinical histories and the microscopical examination of this series of cases of malignant disease cured beyond the three years' limit of time.

Finally, the writer is a strong believer in the doctrine that all tumors, whether benign or malignant, should be removed. Benign tumors should be extirpated because a certain proportion of them undoubtedly degenerate into malignant tumors at special crises or periods of life. This is most apt to occur at a time when physiological atrophy takes place in an organ, as in the female breast, during the menopause. Another reason why supposed benign tumors should be excised is that certain malignant tumors remain quiescent for many years, and for this reason give rise to the belief that they are innocent growths, when in reality they are latent malignant neoplasms. The danger of leaving a supposed benign tumor becomes evident when it is considered that only a small minority of tumors in general are harmless.

Gross collected 649 cases of tumors of the breast, of which 587 were malignant and only 62 innocent. It follows, therefore, that the mere presence of a tumor in the body, especially in the breast, argues in favor of its malignancy, and for that reason the growth should not be permitted to remain. There is no benign tumor in which it has not been demonstrated that it may assume malignancy under favorable conditions.

# OPERATIVE TREATMENT OF CANCER OF LIPS, TONGUE, FLOOR OF MOUTH, AND PHARYNX.[1]

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WHAT are the end-results of our present methods of operating? what changes in such methods, if any, can advantageously be made?—these are the subjects before us for discussion. Leaving out of consideration death due to the operation itself, consequent upon shock, hæmorrhage, or it may be septic infection (each in a large measure preventable), the questions are, In what proportion of cases is recurrence now prevented? and how can that proportion be increased? Where-ever situated carcinoma is for a time local, and its generalization is practically altogether through the lymphatics. Reappearance in the immediate vicinity of the primary growth shows incomplete removal of such growths in the neighboring glands, failure to discover and take away such glands already infected. No operation fulfils the indications, therefore, that does not effect the extirpation of the disease; but when, from the location and extension, the cancer cannot be thoroughly cut away, that operation is best which, saving life for the time being, secures longest immunity from secondary growths, external and internal.

Cancer of the lip, as it commonly presents itself, affects more or less widely the free border with a limited infiltration of the underlying tissues. So long as its locality is thus restricted it can be safely, readily, and thoroughly removed, and the ordinary excision of a V-shaped mass is entirely satisfactory; provided only that so much tissue laterally and towards the chin is taken away, as will include all the diseased area. As respects the extent of removal of lip and chin errors of omission are far in excess of those of commission. It is, however, only in a minority of the cases coming under care that the disease is thus limited. In the course of four, or five, or it may be six months after the appearance of the initial lesion, infiltration of a gland or glands under the jaw has generally taken place. At times unquestionably the glandular enlargement is from irritation, not infection, and will subside after operation upon the lip, but this is so exceptional that it should be regarded as practically non-existent. To this secondary lymphatic disease and the extensions therefrom is due the great majority of the 60 or 65 per cent. of failures to effect a cure, seven-eighths of the recurrences showing themselves within a year.

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[1] This and the following papers on the treatment of cancer in various localities were read before the American Surgical Association, session of 1895.

In all cases, therefore, in which any enlarged gland, be it ever so small, can be felt, it should be cut down upon and removed. Even if nothing can be detected upon palpation, it is certainly wise in any case in which the lip-disease has existed for several months to open up the submaxillary space and thoroughly examine it, for in this form of cancer as in other, infected glands may thus be found, the presence of which cannot be determined through the unbroken skin. The gravity of the operation is but little, if at all, increased by such exploration, and the probability of recurrence will be greatly lessened by the discovery and removal of enlarged glands. In the cases too often seen in which there is extensive disease of the soft parts over and below the jaw, and even of the jaw itself, operation will often afford much relief sometimes, though, unfortunately, but seldom effect a cure. Improvement in the treatment of cancer of the lip must lie in earlier and more thorough operative interference.

Cancer of the tongue is seen in about one-tenth of all the subjects of carcinoma. In the great majority of the cases coming under observation glandular enlargement is present (83 per cent. of the ninety-four Middlesex cases). As a rule, it is developed early, not seldom found to exist as soon as the diagnosis of the tongue-disease is definitely established. It affects the glands under the jaw, those along the anterior edge of the sterno-mastoid, and those over the carotid sheath, one set or all according to the location and the rapidity and duration of growth of the original disease. Rarely is secondary visceral disease developed, as is true in yet greater degree in cancer of the lip.

The end-result of operations has been far from satisfactory, their mortality being high and recurrence very constant. In about 10 per cent. of the cases in recent years, the patients have promptly died (*e.g.*, 55 out of 548 operated upon by Kocher, Czerny, Volkmann, Billroth, Whitehead, Butlin, and at "Guys"), and that after operations of varying kinds and of very varying severity.

Whitehead's death-rate, when the excision affected the tongue only, was 4.5 per cent.

The percentage of secondary growths is at least 75, probably nearer 95, if we could get all the facts. Such percentage in Kocher's cases, the after-history of which was obtained, was about 66⅔ (twenty-five out of thirty-eight). Of Czerny's sixteen cases only one was well after two and a half years. Barker found only 17 out of 173 cases free from recurrence a year after operation.

The growths are found commonly in the glands and surrounding tissues, the unremoved portion of the tongue, and still more its stump when it has been taken away entire comparatively seldom showing recurrence after operation properly done.

These are certainly facts that indicate the wisdom of such an investigation as this we are now occupied with. True, though life is not saved it is unquestionably prolonged (Wölfler's six months' period is probably not too great), and at the same time made more comfortable. But something better must be secured, if possible, and it is possible if operations can be done earlier and especially more thoroughly.

Diagnosis once established, free excision of the affected area should be made without delay that glandular involvement may possibly be prevented. Even if the malignancy of the ulcer or the tumor is questionable, but little time should be spent in removing the doubt. Far better that now and then a tubercular or syphilitic tongue should be unnecessarily operated upon than that a carcinoma should be allowed to widely extend its area. What is the best method of operating? That which permits of the readiest and most complete removal of the disease with least risk to life. No single procedure will always fulfil the indications; the choice of operation must be determined by the conditions of the individual case.

The extirpation of the disease may be done through the mouth, after division of the cheek or through an incision under the jaw with or without section of the inferior maxilla. When the growth has existed for but a very short time and is located in the free portion of the tongue, ablation of such free portion should be made with the knife, or better with the scissors. The attendant hæmorrhage is slight, the wound heals readily, and the functional value of the organ is but little impaired. Situated on the side or in the lateral mass in its anterior half, and of recent development, the Whitehead operation is unquestionably a good one, both as respects its safety and the after-condition of the tongue. Even when the disease is so extensive that the whole tongue must be taken away this method of operating answers well so far as the removal of the organ is concerned. But when the disease, no matter where it may be located, has existed for more than a very few weeks, the glands under the jaw are almost certainly affected, and in the cases as they ordinarily come under care they and often those along the sterno-mastoid can be easily felt if their enlargement be not so great as to cause a manifest swelling in the neck. Under such conditions an intrabuccal ablation of the tongue alone cannot but be followed by so-called recurrence, really not a recurrence, but development of disease already in progress at the time of the operation. Any operation, then, through the mouth, unless done very early and for a limited disease of the tip, or possibly of the side, should be supplemented by an exploratory incision in the submaxillary region, and the taking away of discovered glands. But even thus there is not effected the removal of infected ducts and adjacent tissue lying between the original growth and the nearest glands; and very often, certainly, if not very generally, there is such intermediate disease the leaving of which means failure to cure. If we are to materially increase our percentage of recoveries we must in this region operate more thoroughly, more widely. It is through the neck and the floor of the mouth that we must reach the tongue, along such route only it being practicable to arrive at all the infected tissue; and in following such way hæmorrhage can be reduced to a minimum by ligating the vessels as they are reached, especially the linguals. As we all know, though, in the operations through the mouth bleeding can generally be largely controlled by the use of hæmostatic forceps and ligations in the wound. In the severer more advanced cases division of the lower jaw at the symphysis or on the side will often much facilitate the removal of the disease, and it has been shown that a temporary resection of a considerable portion of the body of the bone may be of great service. Advantages, and by no means slight ones, of the extrabuccal operation are the more thorough drainage that it secures, and the greater facilities that it affords for maintaining an at least approximately aseptic condition of the wound. When it is not the tongue, but the floor of the mouth under the free portion that is the seat of the trouble, operation through an incision below the jaw is easier, can be made much more thorough than through the mouth, even though the incisor teeth be extracted, permits of the ready removal of the suprahyoid gland, if necessary, of those in the submaxillary space, and secures very complete drainage.[1] What is the necessity for or advantages of the two preliminary operations, ligation of the lingual artery and tracheotomy, one or both? Neither, certainly, can be regarded as necessary; each may be of positive advantage as respects the controlling of hæmorrhage. Even in the intrabuccal operations after the lingual has been tied the field of operation is drier, the work can be done more deliberately and more safely it may be; and, further, in doing the ligation opportunity is afforded for the exploration of the submaxillary space and the removal of infected glands. Tracheotomy, besides its making possible plugging of the pharynx, permits of the maintenance of the anæsthesia, a thing not seldom impossible when the anæsthetic is given by the mouth.

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[1] There is no question but that such complete drainage which cannot be secured in any intrabuccal operation greatly increases the chances of recovery. Without free drainage septic infiltration is very likely to occur.

Cancer of the pharynx other than by direct extension from contiguous parts is rare, and affects almost entirely the soft palate or the tonsil. Secondary and associated with grave disease of the tongue or cheek any operative interference is, as a rule having few exceptions, useless, and can only hasten the necessarily fatal termination of the case. Primary and confined to the velum it can be readily removed by knife, scissors, or the cautery ; and if early and widely done, such extirpation is not unlikely to secure exemption from recurrence, if not altogether, at least for a considerable period of time. When it is the tonsil that is the seat of the disease, a condition of infrequent occurrence much rarer than sarcoma, extension to the deep-seated lymphatics so rapidly takes place that it is almost certain to have occurred before professional aid is demanded or diagnosis definitely established. Extirpation through the mouth with or without division of the cheek can very seldom be other than incomplete ; and it may well therefore be questioned whether it is advisable. An extrabuccal operation, while it is more hazardous, does afford opportunity for the removal not only of the tonsillar mass, but of the accompanying enlarged glands. Whether or not the operation shall include division of the jaw is a question that in the light of our present experience cannot be definitely decided. The procedure of Czerny or that of Mickulicz permits, it may be, of more extensive removal than that of Cheever, but the ascertained facts are too few to warrant the statement that the ultimate result is more likely to be the one desired. Recurrence may in any given case be reasonably expected in from three to six months, if not even sooner. A patient of Mickulicz was free for about two years. For the operative procedure of the surgeon just named additional advantage is claimed in the greater freedom of the after-movements of the jaw, because of the removal of its upper part and the less extent of the adhesions formed in the healing of the wound.

# TREATMENT OF CANCER OF THE BREAST.

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I HAVE been able to follow up a certain number of cases of tumor of the breast for a considerable time after operation. A brief statement of the clinical facts of these cases will be made. It will then be possible to reach some conclusion as to the value to be attached to them. A brief statement in regard to a few cases of advanced tumor of the breast will also be made. In some of these cases I operated; in others there was only internal treatment. It may be said that there is no very definite line to separate the operable cases from the inoperable ones. There is no very sure way of determining the virulence of a breast tumor until we have the entire history and destiny of a given case. Yet it may be possible for us to be approximately correct in our prognosis. The surgeon cannot always be sure of the extent of the infection until he operates, and then sometimes he cannot be positive.

Case I.—Miss F., thirty-two years of age, in May, 1888, noticed a lump in her right breast just above the nipple. In September of the same year the family physician enucleated the growth, leaving the rest of the breast. In January, 1889, she came to me for advice, and was persuaded to have the entire breast removed. I operated at once, although she was in poor general health. There was primary union in all parts of the wound. She took the bromide of arsenic and the carbonate of lime for more than a year. She slowly regained her health, and became as well and strong as ever. At the present time she has a perfectly normal scar. Her mother died of cancer of the left breast at the age of forty-two years. At sixty years of age her grandmother had cancer of the breast. In January, 1895, I operated upon this patient for hydrocele of the round ligament.

Case II.—Miss C., twenty-six years of age, had cancer of the left breast which had been growing for a year. Previous to that time the disease had not been noticed. This patient's father died of cancer. December 1, 1888, I removed the breast and contents of the axilla, which had become involved. It is worthy of note that this patient had during the previous year nursed several cases of cancer. The two questions of infection and heredity were considered. Of course there was no evidence in either direction. The bromide of arsenic and the carbonate of lime were given for five or six months. January 26, 1889, I removed a hard nodule from the scar, two nodules above and three nodules at some distance below it. Later in the year she was put under the care of an irregular practitioner. I heard that she died of consumption in the summer of 1893. Did she die of cancer of the lung?

Case III.—Mrs. B., forty-six years of age, had noticed a tumor growing in the lower part of her right breast for about two months. She did not know when it began. February 15, 1889, I removed the breast and the contents of the axilla. There was primary union, and she was up and about in a few days. Dr. W. H. Bates, of this city, made the microscopical examination, and confirmed the diagnosis of cancer. This patient took the bromide of arsenic and the carbonate of lime for two years after the operation, with occasional intermissions. In the latter part of the year, 1893, I removed some tubercular glands from the apex of the right axilla, and since that time she has been in good health. The scar after the breast amputation was soft and normal. The scar after the second operation was also soft and normal.

Case IV.—Mrs. L., thirty-four years of age, had a tumor in the right breast which had been growing for a year. In the mean time a small tumor appeared in the left breast. June 25, 1889, I removed the right breast and the contents of the axilla which had become involved. There was primary union of the entire wound, and the patient was up in two weeks. October 3, 1889, I removed the left breast, leaving the axilla, as it was not involved. There was primary union of the wound in a few days. The patient declined to have both operations performed at the same time. This patient was kept on the bromide of arsenic for more than two years, with occasional intermissions. The growths were examined in the Hoagland Laboratory, and the clinical diagnosis of cancer was confirmed. The scars are soft and normal at the present time, six years after the operations. In the mean time, the patient has had two healthy children, and she is in perfect health.

CASE V.—Mrs. H., thirty-six years of age, in March, 1891, found a lump in her right breast, but did not know when it began. I operated December 17, 1891, removing entire breast and contents of axilla. She was "run down" in health, and very much depressed in spirits. There was primary union of the wound, and she left for home in the country soon after the operation. Her improvement was slow, but she was better after four or five months. It was more than a year before she regained good use of her arm. She took the bromide of arsenic and the carbonate of lime. The bromide of arsenic was continued for about three years, with occasional intermissions. At present she is in perfect health, and has a perfectly normal scar. The growth was examined in the Hoagland Laboratory, and the diagnosis of cancer was confirmed. The pathologist thought that the operation would be followed by speedy recurrence, and a fatal issue of the disease.

CASE VI.—Mrs. O., forty-eight years of age, had her left breast bruised in February, 1891. In the mean time, a cancer developed at the seat of the bruise. She came under my care, and February 25, 1892, I removed the tumor and the contents of the axilla. The diagnosis was confirmed by the examination in the Hoagland Laboratory. There was primary union of the wound of operation. This patient was kept on the bromide of arsenic for more than two years. Two years after the operation a small ulcer appeared in the scar. I exsected this ulcer as far as the healthy tissue, and continued the bromide of arsenic. Since then the patient has been in good health, and the scar has become normal again.

CASE VII.—Mrs. R., forty years of age, had a large tumor in each breast, and one on each side of her neck. These tumors had been growing for about two years. The right breast was beginning to ulcerate and bleed. March 1, 1892, I removed the right breast as far as possible, but there was some infected tissue left. The bromide of arsenic was given to this patient, and the parts healed rapidly by granulation and secondary union. The microscopical examination did not make a positive diagnosis, but the case was said to be malignant and hopeless. In time the scar of operation, as well as the adjacent parts, became quite normal. The tumors in the neck became much smaller. The left breast also diminished in size. The patient was anxious, and requested me to remove the left breast. I operated October 3, 1892, much in the same manner as before. The repair was less prompt than after the previous operation. When the special treatment was omitted for any length of time, the neoplasm began to show itself in the line of the scar; but on pushing the remedies the case improved. The treatment was continued for over two years, and the patient is at the present in a condition of cure.

Case VIII.—Mrs. T., forty-two years of age, had a cancer of the right breast treated for about two years, with the idea of "scattering it." The glands of the axilla had become involved. April 8, 1892, I removed the entire breast and the contents of the axilla. Primary union occurred throughout the entire wound in a few days, and the patient was up and about. With occasional intermissions the bromide of arsenic was given to this patient for the subsequent two years. I saw her in May, 1894, when she had a normal scar, and was in general good health. She removed to Montreal, and I have not heard of her since.

Case IX.—Mrs. P., fifty-five years of age, had cancer of the left breast for more than a year. The tissues were extensively involved and infiltrated, and her prospect was not very good. She was promised temporary relief by means of an operation. May 3, 1892, I removed the entire breast and the contents of the axilla. I was not at all certain that I had removed the infected tissue. The repair of the wound was very slow. For months the scar was red and vascular, and the general health was not good. The marked feature of this case was the great despondency under which the patient labored. The dose of bromide of arsenic was at first one-fortieth of a grain, and it was finally increased to one-tenth of a grain. This remedy was continued for more than two years, with occasional intermissions. At the present time the scar is soft and normal, and she appears to be perfectly well. The microscopical examination confirmed the clinical diagnosis. The case had been considered hopeless.

Case X.—Mrs. G., forty-nine years of age, had a hard cancer of the left breast, which had been growing for about two years, and had extensively involved the axilla. Her mother died of cancer, near the age of fifty, without operation. November 6, 1892, I removed the breast and the contents of the axilla as completely as possible. It required much tension on the sutures to bring the flaps together, so extensive had been the exsection. The appearance and feel of the tissues was the only guide as to the removal of the infected tissue. This patient took the bromide of arsenic for more than two years. The tension upon the soft parts for six months was so great that it required adhesive straps to keep the scar in good condition. At the end of that time the soft parts appeared to slide over and adjust themselves to their new relations. At the present time the health of this patient is fully re-established. There has been no local recurrence, and the scar is perfectly normal.

Case XI.—In January, 1893, I saw Mr. D. in consultation with his physician. Mr. D. was dying from cancer of the sigmoid flexure of the colon. His wife had a year-old cancer of the left breast involving the glands of the axilla. The breast had broken down and was bleeding, and the odor had become offensive. In order to promote her personal comfort I removed the diseased tissue as far as possible. The loss of structure was extensive, and the soft parts could not be brought together. At the end of two weeks she began to nurse her husband again, and continued to do so until his death. She took the bromide of arsenic from time to time. Fifteen months after the operation there was an extensive scar in which were nodules and points of ulceration. I then gave her five-drop doses of the solution of the bromide of gold and arsenic. The ulcers healed, the nodules went away, and the pains ceased. Her general health has been restored. The scar is apparently normal. The examination was made in the Hoagland Laboratory by Professor Van Cott, who confirmed the diagnosis of cancer.

Case XII.—Mrs. F., about thirty-five years of age, had a cancer growing in the right breast for a year, and it had involved the axilla. The nodules in both the breast and the axilla were very hard and firm. October 10, 1893, I removed as completely as possible the breast tumor and the contents of the axilla, obtaining primary union of the entire wound. She went to her home in the country soon after the operation. She has been taking the bromide of arsenic ever since, with occasional intermissions. Professor Van Cott made the examination, and confirmed the diagnosis of cancer. I hear from this patient from time to time. Her general health has been restored, and she has a soft and movable scar.

Case XIII.—Mrs. G., fifty-eight years of age, had a cancer of the right breast about a year, involving the glands of the axilla. She had considerable pain, and was very much depressed. January 10, 1894, I operated in the usual way, and found it difficult to bring the edges of the wound together, so much tissue had to be removed. There was primary union of the entire wound in a few days, with considerable vascularity and redness of the scar. From time to time she has been taking the bromide of arsenic. Her general health appears to have been fully restored, and there is no sign of local recurrence.

Case XIV.—Mrs. C., forty-two years of age, had a hard lump in her left breast just above the nipple, causing considerable pain. Did not know how long it had been coming. The case was one of cancer of the breast with involvement of the axilla to a limited extent. April 25, 1893, Dr. Rogers removed the breast and the contents of the axilla. There was primary union of the entire wound in a few days. The bromide of arsenic, with occasional intermissions, has been continued up to the present. She is now in perfect health, and has a soft and normal scar.

Case XV.—Miss H., forty-five years of age, had cancer of both breasts, which she had observed for about a year. The right axilla was involved. No trace of disease could be found in the left axilla. July 5, 1894, I removed the growth on the right side and the contents of the axilla. The excision was very extensive. It was very difficult to bring the flaps together, and even then there was a small space left open in the centre of the wound. The shock was very severe. The patient's health was in a low state, and it was several days before complete reaction took place. Primary union, except in the small space in the centre, resulted. The patient was taken into the country, where she improved very much during the hot weather. September 20, 1894, I removed the left breast, and did not disturb the axilla as it was not involved. There was only slight shock, and primary union occurred throughout the wound, and the patient was up in a few days. After the first operation five-drop doses of the solution of the bromide of gold and arsenic were given in water after meals, with occasional intermissions. This remedy she has been taking ever since. Her general health has been fully restored, so far as can be seen. The scars on both sides are soft and normal, and there is no indication of recurrence of the disease.

Case XVI.—Mrs. K., forty-two years of age, had a year-old cancer of the right breast, with involvement of the axilla. She was in a poor state of health, and was much depressed in spirits. October 5, 1894, I removed breast and axillary contents, and obtained primary union of the entire wound. She was given the bromide of arsenic in one-fortieth-grain doses, with occasional intermissions.

Her general health slowly returned to its normal standard. The scar is soft and normal, and there is no sign of the disease coming back.

Case XVII.—Mrs. R., thirty-six years of age, had a cancer of the right breast for two years, with much involvement of tissue. December 18, 1894, I removed the growth, together with the contents of the axilla. The operation was extensive and required the exsection of a portion of the axillary vein.

There was some swelling of the arm for a few weeks. Primary union took place in the breast wound. The axillary wound healed by granulation. In the course of a few months the patient regained her general health, and at the present has no local recurrence. From the time of the operation she has been taking the bromide of gold and arsenic, with occasional intermissions. In this case the most that I expected was to gain a brief respite from the ravages of the disease. It is yet too soon to say that there will be a cure.

I have notes of seven cases of advanced tumor of the breast which I operated upon for temporary relief. It does not seem to be important to take up time with them individually. What I have to say may be stated as follows: A patient comes with a large tumor of the breast, and requests you to operate. In operating you find that the local infection has extended beyond the territory of reasonable and safe operation. And the operation is completed as well as possible under the circumstances. It may be that primary union of the wound takes place. It may be that repair goes on by granulation. In any case the repair does not take a long time. In a few weeks or months the disease reappears locally, and in brief time carries off the patient. This unfortunate result may be due to the extent and virulence of the infection, or to the susceptibility and non-resistance of the tissues of the patient who, under special conditions, is incurable.

It may be that the method of operating is important. It is admitted that there may be more than one advisable method. In giving the steps of my operation, the methods of others are not criticised. It is evident that any method of operating requires experience to carry it out well. This is based upon the principle that experience is the best teacher.

It is not necessary to go over the aseptic preparation of a patient for amputation of the breast. Every one is familiar with such preparation. Yet the importance of this point must be emphasized.

Tumors of the breast may be divided into three kinds. (1) Those in which the surgeon may operate with the hope of curing them. (2) Those in which an operation may give temporary relief and comfort. (3) Those in which an operation is impossible and inadvisable. It is evident that the cardinal precept of work must be—the earlier an operation is performed in a case of tumor of the breast, other things being equal, the more certain will be the prospect of a cure.

In an operation of the kind under consideration, there are two important rules of practice: (1) The minimum of time should be taken for the operation. (2) The tumor, as well as its infected environment, must be removed. The earlier the operation, the more successful will be the latter rule of practice. Experience and skill, accompanied by dexterity, will meet the requirements of the first rule.

In the case of an incipient tumor of the breast, the entire breast must be removed. I have seen disaster follow the neglect of this rule. In an advanced operable case, it may be necessary to go beyond the gland structure of the breast in order to remove all the infected tissue. The rule for detecting this infected tissue is based upon the individual experience of the surgeon. He has two guides, the appearance and the " feel" of the suspected tissue. Does the periglandular tissue appear to feel normal? If it does, the surgeon may cease to exist.

The time taken in operating may be from fifteen to forty-five minutes. In operating on the male breast, which is so much smaller than the female, less time is taken. In one of my cases the time was fifteen minutes; in another the time was ten minutes; in still another the time was six minutes. Two of these cases had a complete cure, and the third died of a double pneumonia in a few days after the operation. The time generally required by me in operating in one of these cases has been from twenty-five to thirty-five minutes.

I make a continuous incision around the tumor, including, if possible, all the infected tissue, then the growth is rapidly excised, the hands of assistants following the knife to repress and control hæmorrhage. Pressure-forceps are freely used on all the larger bleeding vessels. If any adjacent or subadjacent portions of infected tissue remain they are quickly cut out. In all cases the submammary fascia is removed, and the sheath of the great pectoral muscle is dissected off in front. A sterilized towel is pressed upon the wounded surface to control the oozing. The contents of the axilla are now excised. The incision extends from the angle of the breast wound so as to expose the growth in the axilla. A pair of long-jawed pressure-forceps is pushed along the surface of the axillary growth so as to grasp the non-infected tissue. With a knife or a pair of scissors, carried along the jaws of the forceps, the tumor is quickly cut away, leaving the forceps in place to prevent hæmorrhage. The process is repeated, using as many long-jawed forceps as required, until the entire growth is cut out.

The pressure-forceps are now removed from the breast wound, which is again disinfected. The bleeding has now for the most part ceased, but a point or two may need twisting. As a rule, no ligatures are needed, the sutures, made of silk, acting as such, when applied as follows: Long curved needles are passed through the flaps, and under the entire base of the wound, and are then tied so as to bring the entire surface of the wound together. These are called deep sutures: and if we refer to their hæmostatic effects, they may be called suture ligatures. Usually the axillary wound is sutured in the same manner, so as to bring its walls into apposition. By this means hæmorrhage is arrested. If any considerable vessel is still bleeding, it may be tied with a suture ligature. The next step is to put in superficial sutures along the edges of the flaps to bring and hold them in apposition, in order to obtain cutaneous primary union. It is rare that primary union fails. In one case not mentioned in the above report, for some reason not well ascertained, I had some suppuration of the wound, accompanied by a serious attack of pneumonia. But the final result was excellent. Even in cases in which the exsection is so extensive that the flaps cannot be brought together, I use the deep sutures. In other cases in which there has been extensive exsection of the contents of the axilla, I have packed the axillary wound with aseptic gauze, and have obtained primary union of the breast wound. Good secondary union of the axillary wound is thus obtained.

In cases of malignant disease, in which systemic poisoning has taken place to any considerable extent, the protoplasm of the cells become depressed in vitality, and there is a certain point in this depression, from which reaction cannot take place by any means at present known. These cases are incurable, even if they are cases upon which we can operate. The toxic product may come from the infecting substance, from the waste of the cells of the body in general, or of from both of these sources. My theory is that an early operation may remove the entire infection, and so effect a cure. But this does not provide against reinfection. This must be sought in some remedy that antidotes the infection. It is probable that more than one remedy will be found. It may be the toxine of some micro-organism. It may be one of the many remedies now known. It may be some remedy yet to be discovered.

As to my cases, Case I has been immune since January, 1889, to the present, over six years. Case II went from December, 1888, to the summer of 1893, and then died of consumption ; I suspect she had cancer of the lungs. Case III has been immune since February, 1889, to the present, over six years. Case IV, both breasts being involved, has been immune since June, 1889, to the present, nearly six years. Case V has recovered and remained immune since December, 1891. Case VI has been immune for six years. Case VII has remained without local recurrence for nearly four years, and the development of the inoperable growths in the neck have been arrested. Case VIII has had no return of the disease after three years. Case IX after three years remains immune. Case X after nearly three years has no recurrence of the disease. Case XI appears to-day, after two and a half years, to be immune. Case XII, operated on October 10, 1893, has recovered her health. Case XIII, after one year and five months, has had no local recurrence. Case XIV has remained immune after more than three years. Case XV at the end of nearly one year is in good health. Her disease was extensive. There is no local recurrence, but I do not say that she is cured. Case XVI, operated on October 5, 1894, appears to be immune. Case XVII, operated on December, 1894, is in good condition, but it is too soon to say that she is cured.

If we were to judge from the seventeen cases above briefly reported, I would conclude that a number of cases operated upon by me and lost sight of, had turned out equally well, provided the after-treatment had been the same. This treatment has consisted, for the most part, in the persistent use of the bromide of arsenic. In some cases this remedy has been given for two or three years, with occasional intermissions. The dose has been from one-fortieth of a grain to one-tenth of a grain. I begin with a smaller dose, and as time goes on the dose is increased in size. In some cases I have employed the solution of the bromide of gold and arsenic, in doses from five to fifteen drops after meals. These remedies have been given on the theory that they are antagonistic to the infection of the disease under consideration. The carbonate of lime has been given to some extent, as an adjuvant to the other remedies, but it is of inferior value, as compared with arsenic and gold.

# OPERATIVE TREATMENT OF CANCER IN THE FEMALE GENERATIVE ORGANS, INCLUDING THE UTERUS AND VULVA.

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CANCER is prone to grow faster in some localities than in others. In the uterus and large intestines it grows slowly; in the clitoris and adjacent parts it grows rapidly, as a rule. I believe the uterus is, next to the breast, the organ most frequently affected by cancer; but primary cancer of the clitoris and vulva is quite rare; at least it has been so in my experience. In considering the subject of cancer of the female generative organs, I will take the organs in their natural sequence, beginning with the ovaries, to which the uterus and vagina are appendages. As I have said elsewhere, we ought to say the ovaries and their appendages, not the uterus and its appendages. The ovaries are the reigning organs, and the uterus and vagina are simply channels for the growth and birth of the ovum, the product of the ovary.

As a general rule, cancer of the ovary occurs as a degeneration of a cystoma, or else it is only a part of a cancerous affection of all the abdominal organs, and is irremovable. Operations in these latter cases are either incomplete or fatal, and always unsatisfactory. In a hasty search through my records I find sixty-three cases of cancer of the ovary, observed after the abdomen was opened; the great majority of them were but parts of a general abdominal cancer and were not meddled with. Occasionally, however, the ovaries are the seat of primary cancer, unaccompanied by any cystic formation, and this cancerous disease may grow for a time at least independently of other organs. In my experience, cases of this character have usually occurred in elderly women from fifty to seventy years of age, and the tumors are somewhat larger than the fist. The ovarian cystomata are nearly allied to cancer. Those patients who recover from simply ordinary ovariotomy are subsequently attacked with fatal cancer of the cicatrix or of the internal organs in ten per cent. of the cases. At least this has been the fact with that proportion of my successful cases, whose subsequent history I have been able to trace.

When a cancerous growth affects one ovary only, or, if affecting both, has not affected other organs, the tumor may be removed with a fair prospect of prolonging life, for some years at least, and perhaps of effecting a cure. Such tumors should be removed with as much of the broad ligament and tube as possible. I can recall at least five instances in which cancerous tumors of the ovary, but slightly adherent, have been removed by me. These tumors were pronounced carcinomatous by Dr. W. F. Whitney.[1] One patient is alive and well, with no external evidence of return of the disease eighteen months after operation. Of the others, two are dead, and two have only lately been operated upon.

There are several varieties of cancer of the uterus, the most common being epithelioma, medullary carcinoma, and adenocarcinoma. Epithelioma of the cervix is most frequent, its symptoms are well known, and I will not enumerate them. The lymphatics from the os and neck go to the obturator and inguinal glands, and those of the body go to the internal iliac, sacral, and lumbar glands. The uterus is especially rich in lymphatics. An operation for removal of a cancer of the uterus, of whatever variety, must include the whole organ; but this, with the removal of the ovaries, tubes, and broad ligaments, is all we can do. There is no opportunity for the removal of a wide margin of tissue or of affected glands. The uterus is bounded so completely by organs whose integrity cannot be encroached upon that the surgeon's task is necessarily confined within narrow bounds. The bladder in front, the rectum behind, and the ureters on each side completely surround the uterus, and the integrity of these neighboring organs cannot be disturbed. In operating, the tendency to-day is to follow the vaginal route.

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[1] Pathologist to the Massachusetts General Hospital.

I take it that it is unnecessary for me to describe the table to be used in an operation for the removal of a cancer of the uterus, except that one needs a table somewhat higher than the ordinary, and one that can be used in the Trendelenburg position if we wish to do so. Nor is it necessary to advert to the previous examination of the urine, the sterilized towels to be placed about and around the field of operation, the necessary instruments, the kind of retractors, etc. Our subject is rather the kind and extent of the operation demanded by the disease than a minute enumeration in an elementary manner of all the preparations and appliances. Suffice to say, that I will suppose every precaution has been taken to insure an aseptic operation. Nor is it necessary to give an elaborate description of the etiology and symptoms of cancer of the uterus.[1] These have been well described by many authors, particularly by Hermann J. Boldt in the work on "Clinical Gynæcology," edited by Keating and Coe.

I usually have my hands manicured the day before an operation, so as to have the nails and fingers smooth and clean, and I usually follow Dr. Howard A. Kelly's method of washing the hands and arms with permanganate solution, oxalic acid, peroxide of hydrogen, and corrosive sublimate, after thoroughly scrubbing with soap and water. We will suppose the diagnosis to have been made, the kind of operation decided upon, and the surgeon and patient ready for the operation. I always put the patient in the lithotomy position.

In regard to the method of operating. It is my belief that in removing cancerous disease of the uterus, in operable cases, the entire organ should be removed. One must decide whether the organ can be removed, or whether the disease has advanced so far that this cannot be done. In cases in which a thorough radical operation is impossible, the surgeon must be contented with thorough curetting and thorough cauterization with the Paquelin or thermo-cautery. In removing the entire uterus, however, the first question to be decided is whether we will pursue the vaginal or abdominal route. For myself, I follow the vaginal route by preference, but if, because of its enlargement or for any other reason, I cannot get the uterus out through the natural passage, I do a combined operation and open the abdomen. The patient is prepared by a proper diet for forty-eight hours; the bowels are emptied by a cathartic and by enemas. The hair is shaved from the mons veneris, vaginal and anal regions, and the abdomen is prepared as for an aseptic laparotomy. This is done in case we find, either from the size of the uterus or from some other complication, that we cannot remove it through the vagina and may be forced to open the abdomen and remove the organ through an abdominal wound. *Everything* to be used in contact with the patient should be sterilized. The patient is clothed in a sterilized flannel suit, which helps to ward off and prevent shock, and this suit is left on for two days after the operation, unless it is found to be too hot and burdensome. The vagina is disinfected with antiseptic soap and water, and with douches of bichloride solution 1 to 5000 or 10,000, and just before making the incision of the vaginal mucous membrane the uterus is thoroughly curetted. This is done under irrigation at first with a mild bichloride solution, and later with boiled water. After the uterus has been cleaned of foul cancerous growth as thoroughly as possible and irrigated, its interior should be swabbed out with pure carbolic acid. I like very much to pass a long, strong ligature of silk through the neck of the uterus and sew up the open os, and use this ligature as a tractor. It is much smaller, more handy, and less in the way than a pair of large double-hooked or single-hooked, so-called bullet-forceps, but we can only do this when the cancer affects the body of the uterus alone, as any traction by a ligature on a diseased cervix is usually followed by the tearing out of the ligature. With adeno-carcinoma this strong ligature of silk can be used, as the neck is usually unaffected in this form of disease. I usually use three of these tractors of silk, which close the canal of the uterus and so prevent the uterine contents from pouring out and affecting the field of operation. These stout ligatures give a firm and unobstructive means of traction. In the ordinary cases, however, when the os and neck are more or less fragile and rotten, we must use double-hooked forceps, or the single-hooked ones that go by the name of bullet-forceps.

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[1] The anatomical relations of the uterus are well described by Dr. M. H. Richardson in the Boston Medical and Surgical Journal, November 2, 1893.

A sound should first be put in the bladder to ascertain the outline of the bladder walls, and this manœuvre may be repeated from time to time, then an incision should be made close to the bladder and around the os beyond the vaginal surface. Next, the mucous membrane should be separated from the cervix, and the bladder must be carefully pushed up and isolated from the uterus. A better hold of the cervix is now possible, if we are using forceps as tractors, as some of it is exposed by the separation of the vaginal mucous membrane. Before the peritoneum is opened above the uterus, the mucous membrane between the os and the rectum should be cut through and Douglas's cul-de-sac should be opened. As soon as this has been done, a sponge with a long ligature attached should be thrust into the peritoneal cavity to keep the fat and intestines from protruding and to absorb any blood that may be poured out. The finger should then, if possible, be passed over the fundus of the uterus from behind to serve as a guide in opening the anterior cul-de-sac. If the surgeon cannot pass his finger over the fundus he must pass it by the side of the body. For separating the bladder from the uterus, we may use the finger more or less, or a blunt dissector, or the scissors, or a spade-shaped instrument, the spade part of which is about three-quarters of an inch wide, and the handles about four inches long. This instrument is often supplied as a periosteum elevator among the instruments for cerebral surgery.

When the anterior cul-de-sac has been opened, either with or without the guidance of the finger from below, a sponge with a ligature attached should be passed in through the anterior opening. The separation of the bladder is much facilitated by the insertion of a metal retractor between the uterus and bladder, which an assistant pulls up under the pubes. During all this manipulation irrigation with boiled water should be continually or frequently practised. The anterior and posterior culs-de-sac having been opened, the tissues on either side of the uterus are torn through with the fingers as far as seems safe without causing hæmorrhage from arterial branches.

The shining peritoneal covering of the uterus is now seen through the anterior opening, and the body may be dragged down from above by successive bites of the bullet-forceps, until the fundus is rotated forward. If the ovaries and tubes follow readily or can be pulled down, they should be removed also with the uterus. After the fundus is rotated forward, compressing forceps with blades at least two inches long should be locked on each side of the uterus from above downward, squeezing the broad ligaments tightly, and the handles of these forceps should be tied strongly together to prevent them from springing apart. The broad ligaments are then divided with scissors, one-eighth to one-quarter of an inch outside—*i.e.*, on the uterine side—of the clamps to prevent retraction, and then the uterus and ovaries also, if possible, should be removed. It is generally better to tie the broad and ovarian ligaments when the ovaries are pulled down. If any bleeding points are seen after the uterus has been removed they should be tied or secured by forceps. I have always used forceps in performing vaginal hysterectomy, but many, perhaps most, surgeons prefer to tie the broad ligaments with silk or catgut. With forceps the uterus is removed more rapidly than when one ties successive portions of the broad ligaments. If the disease extends beyond where forceps should go the operation is not likely to be of any use, as the lymphatics are probably involved. The forceps serve as channels of drainage and keep the vaginal wound from uniting and shutting up septic material within the peritoneal cavity. I never put gauze in the vagina; it becomes very offensive in a few hours and is difficult of removal, and rather obstructs than helps drainage. The sponges that we have placed in Douglas's cul-de-sac and in the pubic region are now pulled out of the abdomen by means of the ligatures, which we have been careful not to have caught and entangled in the compressing forceps which we are going to leave on the broad ligaments. I use only one pair of forceps on each side, as a rule, but many use another pair for the ovarian arteries. A little iodoform or sterile gauze is put around the forceps-handles next to the vulva, and a pad of absorbent cotton is put on the bed for the handles to rest on. No stitches are used to unite the mucous membrane and peritoneum; this union takes place of itself, and we do not want to imprison infectious material. At the end of ten days there is simply a cone-shaped cavity at the upper part of the vagina, where the tissues have become united. No ligatures suppurate out or delay healing, for there are no ligatures. Another excellent way of operating is to tie and cut the broad ligaments piecemeal in successive steps, dragging down the uterus and bringing successive portions of its attachments into view until all of them have been tied. Usually four ligatures are enough, one for each uterine and ovarian artery with the adjacent broad ligament.

This method can also be followed when we use clamps, successive portions of the uterine ligaments and attachments being secured in different clamps. The number of clamps or compressing forceps that one leaves on the ligaments is a matter of indifference, and it is surprising how little pain and discomfort there is after this operation; the patient is generally unaware that she has any clamps in her vagina or any handles protruding. The clamps should be removed after thirty or forty hours, though I have known the handles to break spontaneously the night after an operation and no hæmorrhage to follow. No forcible vaginal douching should be practised at the time when the clamps are removed. I have noticed intense pain and shock to be caused by a douche given at this time. Dr. Cleveland, of New York, has well described the method of removal by successive ligature, and Dr. Boldt that of removal by means of ligatures, accompanied by suturing together of the peritoneum and vaginal membrane, making his operation almost extraperitoneal. Often one cannot rotate the fundus either forward or backward, and the round ligaments and upper part of the broad are either secured in clamps or ligatures before their division, when the uterus is pulled down, or are tied or clamped when they come wholly down and out of the vagina with the fundus. When it is thought necessary to resort to the combined abdominal and vaginal method, it is best to begin in the vagina by separating the bladder as far as possible, and the rectum also, before opening the abdomen. In this case we must employ two surgeons, or else the single one must thoroughly redisinfect his hands and arms in the manner already described before opening the abdomen. One surgeon is, I think, better than two, as the responsibility is not as much felt, and the operation is not as well performed by two men as by one. In regard to the method of operating *à la* Kraske by resecting the sacrum, I have had no experience, but if a uterus could only be removed by this method I should think it was too much diseased and the neighboring tissues too much involved to permit of its being removed at all with any hope of cure. Contrary to the advice of most operators, I raise the head of the bed for a day or two after operating so that gravity may have more force in insuring drainage. In connection with this subject, I cannot refrain from referring to Dr. Lewis S. Pilcher's[1] excellent article on cancer, a most valuable contribution to our knowledge of the clinical results of interference with cancer of the female genital organs.

The cases of adeno-carcinoma almost invariably recover from the operation and are almost always cured. The only hope of curing the other varieties lies in seeing the case before the neighboring structures are involved, so that the removal of the entire uterus, and, when possible, that of the ovaries and tubes also, may possibly put an end to the disease. My own experience in operating for cancer of the uterus has not been extensive. I have removed by vaginal hysterectomy sixteen cases of epithelial cancer, and six of adeno-carcinoma. Of the sixteen cases of epithelial cancer six are living and ten are dead:

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[1] ANNALS OF SURGERY, July, 1894.

One case is alive, state of health unknown, five years after operation.

One case is alive four years after operation, with a very slight recurrence. But the woman looks strong and robust, and her health is perfect.

One case is alive two years and one month after operation; in good health.

One case is alive fourteen months after operation; in good health.

One case is alive four months after operation.

One case is alive three months after operation.

This is a better result than I thought I should find when I sent out letters of inquiry; still, it is not encouraging. All of the remaining ten died within a year of the operation, three within a week, all hopeless cases.

Out of the six cases of adeno-carcinoma five are living and well, without recurrence, and one died from the effects of the operation. I am rather surprised to find that it has not been my simplest and least affected case that has lived the longest. During the removal of the uterus in the case now alive five years after operation, the organ tore in halves and I spent much time in finding and getting out the fundus, which had receded among the bowels, and required much bimanual effort for its recovery; while another case, in which the disease was apparently well-defined, and wholly in the os and cervix, died within a year.

As I said earlier in the paper, if the surgeon finds infection of the structures surrounding the uterus and does not deem hysterectomy of any use, he can curette out all the diseased tissue he can reach, and burn and sear the remainder with the cautery. In this way I have often relieved women of hæmorrhage and discharge for several months. One case lived for three years after curetting and cauterization, but her life was one of great suffering and she consumed an immense amount of morphine, at last taking 120 grains hypodermically in twenty-four hours. Even when cancer does return after a successful and radical hysterectomy, it grows with less pain than it caused originally, as a rule, and the woman is spared much discomfort.

Cancer of the vagina is seldom primary, but at times, very rarely, we meet with it as such. I recall but one case where there were discrete patches of cancer which were thoroughly removed with a wide margin, and in which the woman gained much flesh and strength. The disease never returned in the original site, but the patient died with infection of the inguinal glands, and presumably of the internal organs, in about eighteen months. Cancer of the vaginal mucous membrane should be radically removed as soon as seen. Cancer of the clitoris and urethra, or rather of the meatus, always returns rapidly, and it is of no avail to remove these growths except to get rid of a bloody and offensive discharge for a short time. At least this has been my experience.

With primary cancer of the labia the prospect is better, and sometimes we see the disease when it is confined to the labia alone. The disease is extremely rare, but I recall one case where symmetrical, epitheliomatous tumors on both labia were found to be attached by a long, rather narrow, perfectly defined bases parallel with the long axes of the labia ; these were removed easily with a wide margin of sound tissue, without much hæmorrhage. The patient, seventy-three years old, recovered completely, and died eight months after of apoplexy, no local recurrence having taken place.

# OPERATIVE TREATMENT OF CANCER OF THE MALE GENITALS.

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## Cancer of the Penis.

ONE case of cancer of the penis will be found in about 100 cases of cancer. The disease makes its appearance usually after middle life, appearing in men between forty-five and seventy years of age. It attacks at first the inner surface of the prepuce or glans penis, more commonly the latter. It begins as a small vesicle or nodule, which soon breaks down, leaving an ulcer with densely hard base and edges. The urine and other secretions irritate the ulcer, and its spread is rapid. The tunica albuginea offers some resistance, but after a comparatively short period this barrier is overcome, and the disease spreads to the body of the penis, and extends to the lymphatics and glands of the groin. Secondary deposit is first shown in the glands about the saphenous opening. Involvement of the glands is probably more common than usually believed. Kaufman found it to exist in forty cases out of forty-eight. The same writer gives the average duration of life in cases not operated on as twenty-two months. As soon as a diagnosis is made of the disease, which is usually epithelioma, radical measures should be advised. Syphilis is the only disease with which it may be confounded. The appearance of the ulcer covered with dead epithelium and very hard base, the induration extending some distance around, but intense, and with its limit ill-defined, will generally tell the character of the malady; if not, the microscope will decide the question. If phimosis exists, as it often does, and in my experience often produces the cancer, the prepuce should be split, that complete inspection of the disease may be had.

Both patient and surgeon are often to blame for delay in such cases ; both hope that the ulcer may be syphilitic, and so treat it. Prognosis in early operation is good ; after some delay, especially if iodide of potash and mercury are used constitutionally, prognosis is bad ; after still further delay, and glandular infection has appeared, it is almost, if not quite, hopeless. In the early stage complete excision of the ulcer and its hardened base is often sufficient. The excision should go well outside of the indurated base, not leaving an atom of it. Recurrence of the disease may truly often be charged to incomplete operations. If the location is such as to make the use of the knife difficult, caustic should be used. Here, too, it is better to take away too much than too little. If the cancer has extended too far for simple excision, as is usually the case before the surgeon sees it, then amputation of the organ should be performed.

Amputation of the free portion of the penis is commonly done by a circular sweep of the knife, severing the member above the point of disease ; the urethra is then slit up and attached by sutures to the neighboring skin. The chief objection to this procedure is that the orifice of the urethra almost certainly contracts, the urine dribbles over the neighboring parts, and the cure by granulation is very slow and tedious.

Amputation of the free portion of the penis is better done in the following manner : The hair should be shaved, the parts cleansed with green soap and water, and bathed in a solution of bichloride of mercury 1 to 500. The surgeon should stand on the right side of the patient with his assistant opposite. A soft gum catheter or rubber band should be tied around the penis close to its root to control hæmorrhage. The knife should be carried through the skin at a point opposite the junction of the corpora cavernosa with the corpus spongiosum on one side, and brought up the side and over the dorsum of the penis to a corresponding point on the opposite side. This flap should be convex, the convexity looking towards the glans, and resembles on a small scale the anterior flap of an amputation of the leg or arm. Starting at one end of the anterior flap the knife should now be made to transfix the penis, passing between the corpora cavernosa and corpus spongiosum, and coming out at the opposite end of the anterior flap. The knife should now be carried between the corpora cavernosa and corpus spongiosum for three-quarters of an inch, and then downward and backward to form a posterior flap. This contains the urethra, which should be dissected out of the flap. The corpora cavernosa is now split vertically as far back as the point of transfixion, and then the bleeding points are found and tied with fine carbolized silk ligatures, with the ends cut close. At least four vessels will require ligatures, the two dorsal arteries, and the arteries of the corpora cavernosa; a small tenaculum will secure the last better than forceps. The rubber catheter to control the bleeding can now be removed, and any other bleeding points secured. A small opening is now made in the centre of the anterior skin flap, and the urethra is drawn into this opening, slit up, and stitched in place; at least four stitches of carbolized silk will be required to make it secure. The anterior and posterior flaps are now joined with sutures of silk or horse-hair.

By the method just described a covering of skin is secured for the end of the organ, and repair is more rapid than could possibly be effected by granulation, which is necessary in the old circular operations. For one or two days, and longer, if it creates no irritation of the bladder and urethra, a soft gum catheter is kept in the bladder to carry off the urine. To keep the catheter in place, the stump of the penis and scrotum are carried through a large soft gum ring pessary, which is fastened by tapes or narrow bandages carried around the hips and thighs; to this ring the catheter may be tied with two or more strands of silk. The stump is dressed with iodoform gauze, packed with cotton wool, and the whole kept in place with a long four-tailed bandage of gauze, passing under the perineum and around the hips. The free end of the catheter may be secured in a bottle to catch the urine, by boring a hole in the cork just large enough to admit the catheter. The bottle can lie by the patient's side or between his legs. If the catheter cannot be tolerated, remove it and have the parts when soiled with urine carefully washed with a solution of hydrate of chloral, three grains to the ounce of water, and endeavor to keep the urine acid,—acid urine is aseptic; if very acid it is antiseptic. Its acidity can be maintained frequently by the free use of lemonade.

It is important also to see that the new urethral orifice does not become too small by cicatricial contraction. In the four cases in which I have done this operation I have been compelled to show the patient how to keep this orifice open by the occasional insertion of a short graduated metal sound. The patient should also be instructed to return for inspection every two or three months for a year. If the cancer was epitheliomatous in nature, and taken before lymphatic infection, it is almost certainly curable. Carcinoma extends by the lymphatics, and sarcoma by the blood-vessels, and in case of carcinoma of the genitals the most careful and painstaking inspection of the neighboring lymphatic glands should be made,—if involved, they must also be removed. If the scrotum is involved alone, or along with the penis, the diseased part must be removed thoroughly and completely. The danger in the operation is that the surgeon in his anxiety to save some of the tissue leaves portions of it, if not then cancerous, already infected, and doomed to become so. I have removed for cancer nearly two-thirds of the whole scrotum with permanent cure.

Amputation of the penis is frequently performed with the galvanic cautery, or by the écraseur, and the urethra afterwards treated by the method suggested by Teale. This consists in slitting up the posterior surface of the canal for half an inch, and suturing its mucous surface to the skin. These methods are used by surgeons who dread the loss of too much blood. The truth is, both primary and secondary hæmorrhage have not unfrequently followed amputations after either of these plans. The burnt, or bruised, and crushed surface sloughs, and is slow to heal. Septic troubles are also more likely to ensue; in fact, neither of these procedures has anything to recommend them.

It has been urged that the operation for cancer of the penis just described is insufficient, and that in malignant disease of other organs, as the uterus, testicles, breast, etc., we are not content with any operation short of complete removal. In cancer of the uterus, that organ is entirely removed with its adnexa; in case of the testicles, we take away with that body as much of the spermatic cord as is within our reach, and with the breast, we remove the pectoral fascia and axillary glands. But the cases are not always alike; the form of cancer of the penis is usually epithelioma, that of the other organs just mentioned usually scirrhous or medullary in character, and there is abundant clinical evidence to show that early and complete removal of epithelioma permanently cures. But if the nature of the cancer is scirrhous or medullary, or a long-standing and neglected epithelioma extending as far back as the scrotum, then a more radical operation is called for.

The plan given by Mr. Pearce Gould is probably the best. The operation is complete, and not difficult or very dangerous to execute. After being shaved and cleansed in the usual way, chloroform is given, and the patient placed in the lithotomy position, a large sound is introduced into the urethra, and held in position by an assistant; the surgeon stands between the patient's legs. The scrotum is split along the whole length of the raphé, care being taken not to enter either tunica vaginalis. The dissection is carefully continued, chiefly with the finger and handle of the knife, until the corpus spongiosum is exposed to the scrotal perineal junction, and the incision is then continued backward to the centre of the perineum. The corpus spongiosum is now carefully dissected out, and the sound being withdrawn, it is cut off, being careful to leave it sufficiently long to bring the end out in the perineum; the deep end of the urethra is now cut away from the penis, back to the triangular ligament. Two lateral skin flaps are now made at the base of the penis, and the suspensory ligament divided; at this juncture the dorsal arteries may be caught up and tied. Then with a periosteal elevator the crura are detached from the pubic arch. The crura are firmly fastened, and require some force to detach them. Two additional arteries (those of the cavernosa) and probably other smaller ones will require ligatures. The corpus spongiosum is now brought out at the posterior extremity of the scrotal and perineal wound; the urethra slit up for half an inch, and fastened by sutures to the skin. A small drainage-tube is introduced, and the whole incision closed by sutures. It is not necessary to keep a catheter in the urethra; the compressor urethra not being involved, the patient has full control over the bladder. The inguinal glands, if involved, should be removed. Mr. Wheelhouse suggests that it will add to the patient's comfort to remove both testes.

Medullary cancer of the penis is occasionally, but very rarely, seen. It occurs most frequently in boys, and its origin may be spontaneous, or the result of injury. When once started it spreads rapidly, soon involving the lymphatics and glands. If seen very early, amputation may be resorted to, but the recurrence is almost certain, no matter how early and complete the operation is done.

## Cancer of the Scrotum.

Cancer of the scrotum is so commonly found in persons whose bodies are constantly exposed to the irritating effects of soot, that it is often known as "chimney-sweep's cancer." The same form of cancer is found in operatives engaged in the manufacture of coal-tar and paraffin. It is supposed that one or the other of these irritants are allowed to remain for many days in the deep rugæ of the skin of the scrotum, and in consequence nodules or warts are first formed, and some time after in one of these bodies cancer occurs. These theories, however, are not universally accepted as true, and may be as unfounded as the one that ascribes cancer of the lip and tongue to the use of tobacco. The type of cancer of the scrotum is generally a large or polymorphous cell. Secondary infection is slow to appear; the spread of the disease is not rapid, but if left to itself may involve the whole scrotum, the testicles, and neighboring glands.

The operation must be a radical one. Remove with the knife all the diseased part; if one testicle is involved, it too must be sacrificed; if the glands in the groin are enlarged and indurated, they should be removed. If the disease returns, a second or even a third operation should be done.

### Carcinoma of the Testicle.

The medullary form of cancer is the one most commonly found in cancer of the testicle. Scirrhus is very rarely seen; a few authentic cases are, however, on record. Colloid and cysto-carcinoma are occasionally found. Cancer of the testicle generally occurs in persons between twenty and forty years of age. It is almost unknown in the very young, and is rarely seen after sixty. In one-quarter of the cases seen by Kocher, the disease followed contusions or other trauma. The average duration of the disease is about two years.

Jacobson gives the following points of diagnostic value:

(1) Continual progressing, solid enlargements without inflammation.

(2) Unequal consistence of the swelling at different parts.

(3) Absence of translucency.

(4) Tendency of scrotal veins to become enlarged, and scrotal tissues to become adherent.

(5) Increasing aches and painfulness.

(6) In doubtful cases, antiseptic tapping or exploratory incisions, preferably the latter.

(7) Enlargement of the cord and *a fortiori* that of the lumbar glands.

*Operation; Castration.*—The pubes and scrotum should be shaved and washed with green soap and water, and afterwards with a solution of bichloride of mercury, 1 to 500. This washing should be done some hours before, and again just before the operation is begun. The lower part of the abdomen, upper parts of the thighs and perineum should be included in this washing. The patient should be well purged the day before the operation or on the morning of that day. The inguinal region should be carefully examined for hernia. If the latter is present, it should be returned into the abdominal cavity, and before the operation for castration is completed a radical cure for hernia should be performed. The hernial sac should be dissected out, transfixed close to its neck with a silkworm gut, tied, and the ends left long. The sac should then be cut off close to the ligature. The ends of the ligature are then passed through the pillars of the ring and clamped with a perforated shot. There is thus left an imperishable ligature, which, if surgically clean, will give rise to no trouble, and a radical cure of the hernia results.

Mr. Treves wisely suggests that a large sponge be placed between the thighs and under the scrotum during the operation, to give some support to the testicles.

Everything being ready, the surgeon, standing on the right side of the patient, grasps with his left hand the skin of the scrotum and makes it tense. He then vertically incises the skin from one inch below the external abdominal ring to the lowest part of the scrotum. This wound may be larger than is required to remove the diseased testicle, but it is important for the after-drainage to carry the incision to the lowest point. If some portion of the skin is involved in the cancer, as is not unfrequently the case, instead of the vertical incision, two elliptical incisions should be made, meeting above and below, and including all the diseased skin and subjacent tissues. The incisions should be continued in depth until the tunica vaginalis is opened. The testicle can now be shelled out, partly by being pressed out by the fingers and thumb of the left hand still grasping the scrotum, and partly by being torn out by the fingers of the right hand, the knife being used only when the attachments are too strong to be separated by the fingers. The spermatic cord is now isolated and clamped with one or two strong artery forceps, which are intrusted to an assistant. The cord is then severed three-quarters of an inch below the clamps. The arteries and veins are now carefully caught and tied with fine, well-boiled, silk ligatures; at least three will be required, one each for the artery of the vas deferens, the spermatic, and the cremasteric, and as it will be impossible to tell the arteries from the veins, the open mouths of both from the pressure of the clamp being seen on the stump of the cord, several more ligatures will probably be needed. Before removing the artery forceps which have been used as clamps, secure the end of the stump with a good pair of catch forceps to prevent the end from slipping up into the inguinal canal, where it might begin again to bleed and be difficult to find. Any bleeding points in the scrotum should now be secured. The greatest possible care should be exercised to secure every bleeding point, as secondary hæmorrhage, owing to the laxity of the scrotal tissues, is very common after castration.

Another way of securing the cord, simple and less tedious in its execution, is to transfix the cord with an aneurismal needle, armed with a carbolized silk ligature. The loop of the ligature is cut, the needle withdrawn, and each half of the cord tied. The ends of the ligatures are cut short. As the nerves are included in the bite of the ligatures, more pain accompanies this method, and it is said it has been occasionally attended by tetanus. Neuralgia from injury of the nerve is believed also to have sometimes followed this plan of securing the cord, and suppuration is also not uncommon if a ligature of any size is left around it.

In closing the wound, a long slender straight needle may be used, armed with silkworm gut. Before the sutures are introduced, the assistant should stretch the wound by hooking a finger in each end and pulling its margins straight and taut. This will prevent the edges from being turned in, and enable the surgeon to accurately approximate the margins of the wound. Before tying the sutures, a small gum drainage-tube should be inserted and secured in place by the last stitch.

*After-Treatment.*—Iodoform is dusted over the wound, gauze placed on it, then a thick layer of cotton wool, and over this some protective, like soft sheet rubber, and the whole retained in place by a T bandage. In twenty-four hours the drainage-tube may be removed, and in six days the silkworm-gut sutures.

*Results.*—The danger to life in castration for cancer is very slight in these days of modern surgery. Permanent cures are uncertain. In many cases reported it is not known absolutely whether the disease was cancer or sarcoma. Curling reports four cases cured. In twelve cases, by Winiwarter, there was only one who did not have a return. Kocher reports six cases. In all the presence of cancer was verified by microscopic examination. These cases were alive and without return of the disease at periods varying from one to ten years. If the cure is not permanent, life at least is prolonged and the patient made more comfortable.

When the disease has progressed so far that secondary masses can be felt in the iliac fossa or lumbar region, and especially if cachexia is marked, the operation should not be performed, no matter how urgently the patient may demand it.

### Cancer of the Prostate.

Cancer or carcinoma of the prostate is a comparatively rare disease, but probably of more frequent occurrence than statistics would indicate, owing to the fact that its early symptoms are somewhat similar to those of hypertrophy of the gland, and hence a correct diagnosis is not often made. The disease constitutes 85 per cent. of the malignant growths of the prostate, and occurs in men usually over fifty years of age.

From both a pathological and clinical stand-point, carcinoma of the prostate may be divided into two groups, the hard and the soft varieties.

The clinical course of the two varieties are very dissimilar; the hard or scirrhus type producing obstruction to the flow of urine, frequent desire to empty the bladder, great pain, amounting often to extreme agony, and the presence of blood, and fragments of broken-down tissue in the urine; while the soft encephaloid variety causes little or no vesical symptoms in the early stages, but is manifested by rectal pain, tenesmus, and difficulty in defecation.

In the scirrhous form of the disease, which is the more common, the prostate is enlarged by infiltration of its tissue with cancer-cells, and an examination per rectum will show it to be nodular, bossellated, and of a stony hardness. The normal curve of the urethra is altered, and an attempt to pass a steel instrument will be attended either by great difficulty or by absolute failure.

In the encephaloid form of the disease, the rarer variety, the growth at once penetrates the capsule of the gland, and extends directly backward to the rectum. There is usually no involvement of the bladder, nor obstruction to the passage of the urine, and the symptoms are those due to the projection of a soft ulcerating mass into the lumen of the bowel.

In both varieties there is involvement of the adjacent lymphatics, the formation of secondary deposits in other organs, and rapid emaciation, attended by the peculiar cachexia pathognomonic of malignant disease.

The diagnosis of carcinoma of the prostate is not easy, and can only be made by several observations of the patient. An examination of the urine affords little information. Severe pain, steady growth of the tumor, characteristic stony hardness of the scirrhous type, and the elastic semifluctuating feel in the encephaloid, coupled with hæmaturia or hæmorrhage from the rectum, and emaciation with cancerous cachexia are the symptoms upon which the nature of the trouble is suspected. A microscopical examination of a fragment of the tissue, if obtainable, will settle the question. The duration of the disease is short, averaging from a few months to one or two years. The result of the treatment of these growths in the past offers little encouragement, and usually all that can be done is to palliate the symptoms until death relieves the sufferer.

The symptoms which should induce the surgeon to suspect hard cancer of the prostate, and to distinguish it from prostatic hypertrophy may be briefly stated,—

(1) Frequency and difficulty of urination is greater, and urgency of call more imperious than can be accounted for by the size of the prostate, or amount or residual urine.

(2) It is difficult, often impossible, to introduce a metal sound into the bladder through the warped urethra.

(3) Pain in the pelvis, often extending to the thighs and legs, continuous.

(4) Blood sometimes precedes or follows the stream of urine.

(5) Prostate enlarged, as hard as a stone, and the finger in the rectum can often detect induration of one or both vesiculæ seminales.

Soft cancer is not so easily diagnosed. Its presence is not usually suspected until it has progressed very far. At first the symptoms are rectal, the patient has frequent calls to empty the rectum, tenesmus, blood, and mucous in operations; afterwards and secondarily, frequency of micturition, incontinence, or retention. Rectal examination shows large, soft, elastic tumor, springing from the prostate, pushing backward into the rectum, eventually breaking into that organ, and filling the pelvis.

If the condition of the patient requires it, the bladder should be regularly emptied by a catheter in cases of complete or partial retention, the rectum should be unloaded by enemata, and the stools kept soft by laxatives by the mouth. Sedatives should be given to relieve pain. Opium and belladonna being the most valuable.

In some cases where the rectal symptoms are distressing, the formation of an artificial anus by colotomy may be done with advantage.

No radical operation for the permanent cure of cancer of the prostate has yet been devised. The prostate, and along with it the base of the bladder, have been removed for cancer, but the results have not been such as to encourage a repetition of the operation. Four cases are on record. Partial removal of the organ by means of perineal or suprapubic cystotomy would only end like partial removal of a cancerous mass in the breast or in any other gland,—that is, add to the trouble. Perineal drainage would not be tolerated, and should never be attempted. The incision and presence of a tube in the neck of the organ would add to the pain and irritability of the bladder, and rapidity of growth of the cancer.

Suprapubic cystotomy and drainage give physiological rest to the bladder, and immense relief in these cases. When the bladder has been opened by the simple suprapubic incision, the diseased prostate can be thoroughly examined by the finger introduced into the bladder. If, at the same time, the index-finger of the other hand is introduced into the rectum, a bimanual examination is made, and the extent and character of the malady exactly mapped out, or a small electric light introduced through the suprapubic opening permits of complete inspection of the vesical surface of the growth. The catheter used for drainage after the cystotomy should not be allowed to touch the prostate or lie in the bladder; it should have its opening on the vesical end of the instrument and not on the side, and should be placed only through the wall of the bladder. These rules apply to drainage for any cause after suprapubic cystotomy.

In one case under my care of suprapubic artificial urethra for hard cancer of the prostate, the patient wore for a year a silver plug to prevent the track from closing, and when the urine accumulated in the bladder, the plug was withdrawn, and a soft gum catheter introduced. When the water had all escaped, the catheter was taken out, and the plug replaced. In this way nearly all of the pain and frequency of urination was avoided. Pain in pelvis and legs, and other symptoms of cancer, continued until his death.

Fenwick, in discussing the subject, says that few surgeons will admit that the operation of complete removal of the cancer is worth a trial, and that partial extirpations are useless, and only aggravate the disease, and Whitney, in closing an admirable paper, in which he reports a case says, " Any operation to be of value must be early and radical; but when it is remembered that in 80 or 90 per cent. of cases confirmed by an autopsy other important organs or glands were involved, and that the diagnosis of this affection in its early stage is a matter of the greatest difficulty, the ultimate success of any operation is a matter of grave doubt."

# THE MODERN OPERATIVE TREATMENT OF CANCER OF THE RECTUM.

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IT will best accord with the purpose of the discussion of the subject of the operative treatment of rectal cancer if we confine ourselves to the consideration of the matter in hand under the following headings:

(1) The modern methods of attack employed in extirpation and the details of the after-treatment.

(2) The preservation of or substitutes for the sphincteric function.

(3) Remote sequelæ of these newer methods.

(1) *Methods of Attack.*—In reviewing the field of the operative treatment of malignant neoplasms of the various regions of the human body, none presents a more pronounced tendency to a fruitful development than that of the digestive tract, and of this tract more notably the rectum. When we examine the imperfect, and therefore bloody and dangerous procedures devised by Dieffenbach, Lisfranc, and Velpeau, together with the high rate of mortality accompanying the radical operations of these authors and their contemporaries, our wonder is that any surgeon should have had the temerity to attempt the removal of an extensive rectal neoplasm. All of these procedures were characterized by the approach to the rectal tumor from the anus by a circular circumanal, or from a coccygeal, or from a perineal incision. Hæmorrhage was inevitably copious, no means were taken to prepare the gut, and infection of the wound was the rule.

A large proportion of the patients operated upon died of so-called shock—that is, acute anæmia—within a few hours after the operation; a considerable fraction of the surviving succumbed to septic processes established in the wound, extending to the retroperitoneal spaces and to the peritoneum. Hence the unwillingness of careful surgeons to extirpate, and their preference for a much safer palliative plan of treatment by colotomy is fully justified by the fatality following radical procedures.

A remarkable impetus towards a betterment of this hopeless attitude of rectal surgery was initiated by the genius of the Hallensian surgeon, Richard Volkmann, whose observation, that rectal cancers were less malignant than those of the female breast, and less prone to speedy relapse, encouraged him to renewed attempts at improving the technique of this field. The introduction of antiseptic methods was at once followed by improved results, as the diminished number of septic injections materially bettered the rate of recoveries. However, an imperfect control of hæmorrhage caused by the limitations of available space, and the undue prolongation of the time required for an extensive extirpation, and finally, accidental injuries to the peritoneum which passed unnoticed were still followed by too many deaths to encourage a general acceptance of radical operative treatment. Let us then state that the principal dangers of the extirpation of the rectum were mainly caused by inaccessibility of the region.

The late noteworthy revolution in the methods of surgical therapy of the rectum was based upon an accidental observation made by Volkmann in 1883, who in removing a periosteal sarcoma of the sacrum accidentally opened the sacral canal. The patient did not suffer any serious damage from this dreaded accident, and promptly recovered. This observation encouraged Kraske, then assistant of Volkmann, to study experimentally the question of sacral injuries, and as a fruit of these studies appeared his remarkable publication in 1885,[1] initiating a new epoch in this branch of surgical activity. It is true that as early as 1874, Kocher had extirpated the coccyx as a preliminary step to proctectomy, but the importance of this departure cannot be compared with that of Kraske's excision of the left half of the lower portion of the sacrum up to the third sacral foramen. By this the surgeon was enabled to approach the gut from behind, and to attack a large number of tumors from above. The separation of the rectal cylinder from the surrounding organs became a rapid, unbloody, and safe process, and both the dangers from copious uncontrollable hæmorrhage and from an accidental infection of the wound and peritoneum were materially diminished.

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[1] Archiv für klinische Chirurgie, Vol. XXXIII, p. 563.

Purely anatomical considerations, perhaps, more than Kraske's first two successful cases, served to encourage all surgeons to a cultivation of this neglected field, and as a result of this renewed interest and hopeful activity we see not only a remarkable extension of the legitimate indications for surgical interference with rectal neoplasms, but especially a very encouraging improvement in the rate of mortality, which descended from 57 per cent. (Iversen) to 20 per cent. (Krönlein).

The relative position of colotomy was also considerably changed by these new tendencies, and in two ways : First, the number of colotomies, done as a purely palliative step, was steadily diminished, until it is now confined to clearly hopeless inoperative cases, or such instances of the malady where internal deposits complicate a small, otherwise removable tumor. On the other hand, we have learned that success depends to a great extent upon as thoroughgoing an application of asepsis as the difficult field of the intestinal tract will admit. Hence, where on account of a considerable constriction a thorough evacuation and cleansing of the gut is impossible, preliminary colotomy is practised universally to enable us to dislodge fæcal matter deposited and impacted above the stricture. The diversion of the stream of fæces will eliminate local inflammatory congestion, rendering subsequent extirpation much less bloody, and the freedom from septic fever will cause an improvement in the general condition of the patient, gladly welcomed by every surgeon, before risking a serious operation. The advantages of preliminary colotomy are so great that not a few surgeons, as, for instance, Schede and Kammerer, wish to see it established as a generally accepted measure. However, it seems to me, and this view is borne out by personal experience, that colotomy is only indicated where a satisfactory cleansing of the large gut is rendered impossible or even difficult by whatever cause, and more so preceding resection than amputation, and this for obvious reasons.

We see, then, that more and more stress is laid upon a thorough evacuation and cleansing of the gut as a preliminary aseptic measure with or without colotomy, which course of evacuations, to be sufficient, must extend over one or more weeks before extirpation. The method of colotomy universally employed at the present time is the inguinal one, the artificial anus being usually located in the left side. Where extensive disease is combined with a naturally short meso-colon, the author and other surgeons have found it useful to locate the colotomy wound in the *right* side of the belly, as this *situs* of the attachment of the gut to the abdominal walls would not interfere with the pulling down of the rectal stump. After successful extirpation the artificial vent is usually closed.

Great as the advantages were of Kraske's procedure, the mutilation involved and the weakening of the pelvic floor engendered by it soon induced others to try to improve upon it. Kraske's procedure, done through a median longitudinal incision, was first modified by Heinecke,[1] who made a T-shaped external incision, dividing the sacrum and coccyx along the lines of the external incision, thus producing two lateral triangular osteo-integumental flaps, which were to be replaced and sutured after the rectal operation was finished. Heinecke's operation was modified by Kocher[2] with a view of enabling the surgeon to divide the sacrum above the third sacral foramen without injury to the third and fourth anterior sacral nerves. Another innovation of the manner of approach to the gut was made by Levy,[3] who recommended an incision of the shape of an inverted capital U, the arc of the letter corresponding to the transverse section through the sacrum, the squarish flap to be turned down towards the anus. His object in devising this plan was the sparing of the fourth sacral nerve, and of the levator ani, which it supplies, the loss of these organs being often followed by a prolapse of the rectal stump. The space afforded by this method is very limited, and drainage very defective.

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[1] Münchener medicinische Wochenschrift, 1888, No. 37.

[2] Arnd, Beitrag zur Statistik der Rectumcarcinome, Deutsche Zeitschrift für Chirurgie, Vol. XXXII.

[3] Zur Technick der Mastdarmresection, Centralblatt für Chirurgie, 1889, No. 13, and idem, Berliner klinische Wochenschrift, 1893, No. 13.

Hegar[1] employed a V-shaped osteo-integumental flap, the basis of the triangle corresponding to the section through the sacrum, to be done by the aid of a chain-saw subcutaneously.

The objection to Heinecke's and Kocher's complicated wounds is counterbalanced by the advantages due to the preservation of the lateral blood-supply. Hegar's incision destroys the lateral nutrient channels, compromising the vitality of the resected bone, but affords excellent drainage. Levy's incision is objectionable in every way.

However valuable these modifications of Kraske's plan may be in resections of the rectum, their value is doubtful in cases requiring amputation of the gut, where the establishment of a sacral fixation of the stump is most desirable.

In a noteworthy publication, based on the considerable experience of thirty-two cases gained in Albert's clinic, Hochenegg,[2] of Vienna, recommended a parasacral incision, commencing at the median line of the sacrum just below the third foramen, and describing an outward curve passing the median line a second time just below the apex of the coccyx. Should it be desirable to excise the anus, this end of the incision bifurcates near the coccyx, uniting again in the perineum. The sacrum is excised as by Kraske. The incision gives excellent access not only to the rectum but also to the uterus and its adnexa.

Rehn, of Frankfort, reported at the Congress of General Surgeons, held in April, 1890, a number of successful cases of excision of the rectum operated upon by a new incision also resembling the capital letter V, but laid so as to cross the entire width of the sacrum below the height of the third foramen by one of its legs, the other leg running from the left angle of this horizontal incision downward and close along the left-sided outer margins of sacrum and coccyx. After the liberation of the left outer edge of sacrum and coccyx, these are separated by blunt dissection from the underlying rectum, and the sacrum is divided with saw or chisel along the horizontal cut. The triangular osteo-integumental flap is turned out towards the right. The space thus gained gives excellent access to the rectum, and a sufficient blood-supply is preserved at the same time.

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[1] Von Beck, Die osteoplastische Resection, etc., Inaugural Dissertation, Freiburg, 1889.

[2] Wiener klinische Wochenschrift, 1889, Nos. 26–30.

Strangely, Rehn's procedure seems to have entirely escaped the notice of Rydygier,[1] who published an identical operation in 1894, not mentioning Rehn at all in his paper read on September 27. An unsavory altercation arose about the priority of this method, which, however, seems all the more pitiable, as the identical measure was successfully employed as early as 1889 by Billroth[2] in one case of his private practice, and reported to the Vienna Medical Society. For resection of the rectum this incision is undeniably useful, and was extensively adopted by many surgeons in New York, notably by those attached to the German Hospital,[3] who reported within the past year eight cases with one death only.

Emil Zuckerkandl,[4] the Vienna anatomist, proposed an incision beginning at the tuberosity of the left ilium, running, with its convexity looking to the right, along the left margin of the sacrum, and terminating midway between anus and the tuberosity of the ischium. Wölfler[5] accepted this plan, adding to it the excision of the coccyx. Both Föderl[6] and Wölfler were favorably impressed with this method, and report a number of cases successfully operated by it. The only objection to it is the limitation of space caused by the intact sacrum.

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[1] Centralblatt für Chirurgie, 1894, No. 45.

[2] Föderl, Wiener klinische Wochenschrift, 1894, p. 251.

[3] Kammerer, F., ANNALS OF SURGERY, Philadelphia, 1895, XXI, 1–8; Meyer, Willy, Ibid., 1894, XIX, 675; Gerster, Arpad G., Demonstration at Meeting of American Surgical Association, 1895.

[4] Wiener klinische Wochenschrift, 1889, Nos. 14, 16, and 18.

[5] Ibid., 1889, No. 18.

[6] Beiträge für Chirurgie des Rectums, etc., Wiener klinische Wochenschrift, 1894, p. 249.

Borelius,[1] of Karlsbrona, introduced within the present year another line of attack, called by him by the equivocal name of "posterior sacral incision," the object of his method being the avoidance of injury to the sacral nerves, leading to vesical trouble. The incision begins at about the middle of the sacrum in the median line, is carried vertically downward to the apex of the coccyx, whence it swerves to the right side, following the course of the lower margin of the glutæus maximus as far as the surgeon's wish may determine. The right margin of this wound contains the skin and below it the fibrous insertion of the glutæus, which are detached from the bone and drawn aside with a retractor. After this the left margin of the wound is freed somewhat, to enable the surgeon to divide the sacrum with chisel and mallet diagonally, the line of division running from the lower margin of the left third sacral foramen to the lower margin of the right fourth sacral foramen. Now the right margins of the lowermost sacral vertebra and of the coccyx are liberated with the scalpal, after which step it is easy to draw the osteo-integumental flap thus formed over to the left side. The report of three successful cases accompanies the publication.

It is very curious that the vagina, offering such a ready and accessible roadway to the rectum, had so long escaped the attention and ingenuity of enterprising rectal surgeons. Before the zeal of Rehn,[2] the last barrier has fallen, who, however, must divide honors with Campenon,[3] a Frenchman, who had published an identical procedure a short time preceding the German author. The steps of this operation are as follows: After disinfection of rectum and vagina and plugging of the former, the posterior vaginal wall is divided by a longitudinal median incision, extending downward through the raphé of the perineum to the margin of the sphincter ani, giving ready access to the anterior aspect of the rectum. Hæmorrhage is said to be very scanty, and circular blunt liberation very easy. The gut is divided in healthy tissues above the cancerous tumor between two mass ligatures, applied as a protection against infection by intestinal contents. The proximal stump is drawn forward by an assistant, while the surgeon grasps the diseased portion of the gut, dissecting it out of its attachments without difficulty. The control of hæmorrhage is obviously easy, and the peritoneum can be readily invaded if necessary. This incision is applicable both for resection and amputation of the rectum. After fixation of the stump in amputation, or after proctorrhaphy in resection, the vaginal and perineal wounds are closed by suture, drainage being provided for by the insertion of a couple of stout rubber tubes along each side of the intestine. Rehn's only patient, upon whom this operation was done, died of peritonitis due to avoidable infection and retention. Before leaving this subject a valuable proposition of Rehn's may be mentioned, deserving trial. He suggests that after liberating the gut from the vagina the diseased part of the gut could be invaginated and protruded through the anus, enabling the surgeon to resect and sew, or to amputate extrarectally, the dangers of infection being thus materially lessened.

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[1] Centralblatt für Chirurgie, 1895, p. 59.

[2] Centralblatt für Chirurgie, 1895, No. 10.

[3] France Médicale, 1894, No. 45.

However, the enumeration of all possible routes of attack upon rectal tumors would not be complete, if we omitted to mention a plan suggested by an Australian, Maunsell, of Melbourne, first successfully employed by our townsman, Frank Hartley,[1] for the removal of a recto-sigmoidal intussusception. Obviously the same process is applicable in carcinomata, situated near the junction of rectum and flexure. In Hartley's case median laparotomy in Trendelenburg's posture gave access to the tumor situated within the rectum and surrounded by a double invagination. The outer or second intussusception was reduced with slight difficulty. This did not allow the tumor to be brought into the abdomen proper. With a partial reduction of the first intussusception, however, it could be brought above the iliac fossa. The case is so interesting that I venture to continue to

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[1] New York Medical Journal, October 22, 1892.

quote the author's own words. "Considering the condition of affairs—a tumor within the gut with an intussusception—the natural method of operation seemed to be that recommended by Maunsell, of Melbourne, Australia, for in this way the sloughy mass could be reached, cut loose, and delivered without any possible contamination of the peritoneal cavity. Consequently a long incision three inches in length was made over the lower segment entering the intestine; intussuscipiens, the tumor, and intussusceptum were delivered through this opening after protecting the mass with additional gauze.

"The intussusceptum was then divided transversely a little below its neck. The divided ends were held in position until the arteries in the mesenteric border were securely ligated. Silk sutures were then passed through all coats of the intestine as they were held in position according to Maunsell's recommendation and tied.

"One or two catgut ligatures were placed in the mucous membrane alone where it gaped. The fold was then reduced and a Lembert suture was carried around the intestine above the larger and deeper sutures. After this the longitudinal incision in the lower segment was sutured by a few stitches of silk in the mucous membrane and a Lembert suture in the serosa and submucosa. The cavity was wiped out with a sponge. The abdominal incision was closed with silkworm gut. Rubber tissue applied over the line of incision and a bichloride dressing applied. After operation the course was uneventful, temperature having never arisen above 100° F., or the pulse above 96."

Having passed in review the various ways of removing rectal tumors, it will be proper to make a few critical remarks regarding their value. Almost all have something to commend them, but none is entirely free from objection. So much may be said, in summing up, that Kraske's old operation, and the Hochenegg plan, deserve the preference in high amputations of the rectum. Zuckerkandl's plan and Rehn's vaginal procedure have a limited applicability in favorable cases, both for amputation and resection. All the osteoplastic procedures are useful mainly in resections of the gut where the sphincter can and is to be preserved. Of all these the Billroth-Rehn-Rydygier incision seems to be the most useful one.

Before closing the consideration of anatomical approach, some technical points of great practical importance may be touched upon. All surgeons agree in saying that operating upon rectal tumors, whether the patient be in a lateral, prone, or supine decubitus, is rendered easier by a decided elevation of the pelvis, which notably has the effect of diminishing hæmorrhage. With the exception of Bardenheuer, who advises the employment of blunt separation at all hazards, even using considerable force, all surgeons favor careful and methodical dissection, blunt where this is feasible, and division of resistant bands between double ligatures, where the former plan is not applicable. Extensive gangrene of the rectal stump, reported by Bardenheuer, was probably due to tearing of the middle hæmorrhoidal artery. To the same accident must be ascribed one death caused by uncontrollable hæmorrhage of the torn and retracted artery.[1]

Whether, in dividing the sacrum, the chisel, saw, or bone-cutting forceps should have the preference seems hardly to deserve serious discussion, each surgeon having his own predilection and doing excellent work with any one or all of these instruments.

In taking care of the divided rectum the subsequent steps will depend upon whether an amputation or a resection was done.

Where high amputation is to be performed, the surgeon must try sedulously to preserve the nutrient vessels of the mesentery, otherwise the entire rectal stump may mortify. This will be found most difficult in that part of the rectum which adjoins the flexure. Lateral incisions through the peritoneal attachments are permissible, but cutting into the mesenteric line itself will certainly be followed by disaster. Adequate lateral incisions will permit the surgeon to peel up the gut from the sacrum by the gentle use of the finger-tip. The higher this detachment of the gut is carried up, the less tension will have to be encountered in drawing down and attaching the stump to the upper angle of the external incision, especially where portions of the sacrum had been removed. A few stout silk sutures passed through the entire thickness of the gut laterally will serve amply to anchor the gut to the skin, the rest of the wound remaining open. In cases where the peritoneal cavity has been invaded it is best to stitch up carefully the peritoneal wound as soon as possible. Though some surgeons advise to leave open the peritoneal cut, the former procedure has mostly received and deserves preference.

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[1] Morestin, Suites et Complications des Interventions par la Voie sacrale pour le Cancer du Rectum, Gazette des Hôpitaux, 1894, p. 326.

The recesses of the wound are to be packed loosely with iodoform or absorbent gauze, and the dressings are safely held in place by a large diaper rather than a T-bandage.

As better access was gained by the methods above described to the higher portions of the rectum, the scope of amputation was extended farther and farther, the difficulty of bringing down the stump to the skin increasing in proportion. The rule was to sacrifice the sphincter, even if it was healthy. Finally, it occurred to several surgeons that it would be rational and desirable to preserve the sphincter and lowermost portion of the gut, should they be healthy, uniting the upper and lower sections of the rectum by stitches analogously applied as in other forms of enterorrhaphy. Most of these first attempts failed either completely or partially, leakage resulting not rarely in death by sepsis, or at least in the establishment of very troublesome and rebellious sacral fistulæ. Hochenegg's proposition to invaginate the stump into the lower segment of the gut, drawing it out through the anus and attaching it to the skin, was gladly accepted as an improvement, and was still further improved by the denudation of the epithelial lining of the anal ring within the sphincter. When practicable, it gave better security against fæcal contamination than an ordinary enterorrhaphy.

Lange,[1] of New York, endeavored and succeeded in overcoming the same difficulty by resorting to an original method of anal plastic. After resection was finished by Kraske's procedure, a curved incision was carried in front of the anus from one tuberosity of the ischium to the other, penetrating as far as the ante-

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[1] Centralblatt für Chirurgie, 1893, No. 30, p. 645.

rior fibres of the levator ani, some of which were also divided. Thus a massive bridge-like flap was created, having two broad lateral attachments, and containing the lower—that is, anal—segment of the gut, together with its sphincteric apparatus. It was sufficiently movable to permit a displacement upward amounting to two inches, which went far towards facilitating a union by suture with the proximal stump of the rectum. The present writer can testify to the excellence of this procedure from a personal inspection of the patient.

Maunsell's method of invagination suture, as related in Hartley's case, having received due mention, we have to complete the account of surgical efforts to facilitate rectal suture after resection by referring to a case successfully operated on and reported by Marcy,[1] of Boston, who effected an end-to-end approximation with Murphy's button after having excised four inches of the gut. Murphy[2] mentions two additional cases of resection of the rectum followed by union effected with his button, proposing in the same article a method of resecting with the aid of invagination similar to that suggested by Rehn,[3] and previously mentioned by us.

Two great drawbacks must be charged against resection followed by suture of the rectum. One is the frequent failure of all known forms of suture to yield primary union; the other is the development of more or less pronounced stricture corresponding to the line of suture. Early leakage caused by incomplete union is very often followed by sepsis, while unrelieved stricture at the line of union results in coprostasis, ulcerative enteritis, breakdown of the sacral cicatrices, and the establishment of more or less troublesome sacral fæcal fistulæ.[4] The defective nature of the prevailing methods of uniting divided intestine is nowhere more apparent than in the rectum, where even a moderate constriction by cicatricial deposits will create a serious barrier to the propulsion of the intestinal contents. The fæces having become compact and tenacious by the time the rectum is reached, will be

[1] Medical Record, June 2, 1894, p. 687.

[2] Chicago Clinical Review, February, 1895.

[3] Centralblatt für Chirurgie, 1895, No. 10.

[4] Morestin, loc. cit.

impeded by a stricture which would readily permit the transit of liquid matter. Murphy's button, invagination according to Maunsell and Hochenegg, and the usual forms of end-to-end suture are all alike open to the same objection.

Though certain surgeons advise closure by stitching of the external wound in resections, this plan of after-treatment has been the cause of death too often to be called safe. And in view of the great difficulty of obtaining absolute asepsis in rectal operation, the open plan of after-treatment deserves all the more the preference, as it is generally reported that the cutaneo-osteal flaps become firmly attached to their normal *situs* in those cases where the wound healed by granulation.

Whenever fever develops, a careful examination of the wound and its recesses should be made, if necessary, with the aid of anæsthesia. Very often the exact locality of a retention can be accurately determined by insertion of the finger into the gut and gentle palpation of the surrounding tissues through the rectal wall. Retention unrelieved may easily cause phlegmonous extension of the suppurative process into the retroperitoneal space and perforating peritonitis as late as a fortnight after the operation.

As to the management of defecation we see a wide divergence of opinion. The majority of authors advise a free use of opiates with a view of retarding as much as possible the first evacuation following operation. Murphy alone advises an early and free use of laxatives on account of his desire of keeping the vents of his button free from glutting with solid fæces. I myself have mostly employed the opium plan, but could not ignore the fact that the more defecation was retarded, the more difficulty was encountered afterwards to restore a complete and normal function. By " complete," a thorough and single evacuation of the lowest portion of the gut is meant. If this is not secured, solid fæces will escape at short intervals into the dressings, necessitating frequent and irksome disturbance of the patient.

On the other hand, if the wound be properly protected by packing, an early evacuation, say forty-eight hours after the operation, will do no serious harm, provided that the deep packings, safely protecting the inner recesses of the wound, be not disturbed.

The tedious after-treatment will become much less irksome if the patient is encouraged to leave the bed as soon as possible, and to begin to exercise moderately. With a clean granulating wound, however large, locomotion and sitting down are not painful, and early active efforts will go far towards preventing marasmus and demoralization, so often engendered by prolonged decubitus. An early regulation of the digestive tract, local cleanliness and a proper hygienic *régime* are the main points of a successful after-treatment.

(2) *The Preservation of or Substitutes for the Sphincteric Function.*—To preserve the sphincteric apparatus wherever possible, and not to interfere with its nervous supply by respecting the integrity of the upper three pairs of the sacral motor nerves has become a gradually accepted principle of modern surgery.

How to provide a surrogatum for lost sphincteric action has been the subject of a number of more or less successful attempts. Willems,[1] Rydygier,[2] and Witzel[3] have proposed within a comparatively short period of time methods almost identical and differing only in some unessential details, consisting of an ingenious utilization of part of the glutæus muscle for the occlusion of the amputated and otherwise patulous rectal stump. The essential part of this plan is to make a short external incision a certain distance away from the free margin of the glutæus muscle, to perforate this and to separate its fibres by blunt methods sufficiently, permitting the surgeon to bring out the rectal stump through this musculocutaneous slit, finally attaching the edges of the gut to those of the skin wound. Witzel reports six successful cases operated on in this manner, whereas Willems's and Rydygier's propositions were based on cadaveric experiments only.

Radically different is the procedure advocated by Gersuny,[4] consisting in simple torsion around its own axis of the extremity of the rectal stump, followed by fixation of the twisted gut to the skin by suture. An elastic resistance to the pressure of the fæcal column is thus generated, sufficient to retain solid and liquid matter until the resistance be overcome by voluntary intra-abdominal pressure exerted by the patient himself. The tissues of the rectal wall are thrown into a system of spiral folds, resembling the rifling of a gun. Gersuny himself published two, and the author of this paper has observed three cases, in which this method has yielded excellent success. Two of these were published.[1] Gersuny's method being the simplest, and not requiring extra dissection at the end of an in itself sufficiently bloody and exhausting operation, certainly deserves preference and extensive trial.

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[1] Centralblatt für Chirurgie, 1893, No. 19.

[2] Ibid. 1894, No. 45.

[3] Ibid. 1894, No. 40.

[4] Centralblatt für Chirurgie, 1893, No. 26.

(3) *Remote Sequelæ other than Incontinence.*—The brevity of the time allotted to me will not permit of an exhaustive treatment of this most interesting chapter at the present time, but those who are interested in the subject may find much worth reading in Morestin's excellent article quoted in this paper before. Prolapse of the rectum is one of the late sequelæ of sacral operations upon the cancerous rectum. A patient of Ricard,[2] whose wound had healed in three weeks, experienced on the day of her discharge, in lifting a heavy object, a sudden rupture of the fresh scar, followed by extensive prolapse of the rectum. Morestin mentions three other cases observed by him among a limited number of patients subjected to rectal extirpation by sacral methods. He explicitly states that prolapse was never observed in those instances where the wound was allowed to heal by granulation, the explanation being in the firm fixation of the lower end of the gut to the sacrum and the rest of the pelvis by massive cicatricial deposit, and the impossibility for invagination. Where prolapse existed, the anal orifice was always situated on the posterior aspect of the tumor, near the sacrum. Occasionally the mass even contained small intestine, representing an anal hernia. The cure of these conditions is either by amputation,

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[1] Medical Record, February 10, 1894.

[2] Morestin, loc. cit., p. 329.

which, however, may properly be delayed, if possible, with a view to the occurrence of relapse, or by proctopexy or colopexy, —that is, the anchoring by suture of the rectum or colon so high up against the abdominal parietes as to preclude the possibility of prolapse.

Regarding the influence exerted by extensive operations about the pelvic floor, we may say, that Morestin mentions two well-observed instances of procidentia uteri directly produced by Kraske's operation.

Sacral fistulæ are the bane of modern rectal surgery. They are either *primary*, caused by defective suturing of the gut, or *secondary*, produced by late ulcerative proctitis based upon the presence of stricture. We had stated before that resection is invariably followed by stricture, no matter what form of approximation—suture or Murphy's button or invagination—was used. This stricture is usually valvular, either semicircular or circular, and appears very early, as early as the fourth week after operation. It frequently escapes attention, especially where the fæcal movements are influenced by laxatives. Frequent digital examination of the site of the suture is indispensable, and will lead to an early detection of stricture, which, met at once by systematic dilatation exerted with a soft rubber bougie, will generally yield to treatment and disappear.

Neglected, it will contract more and more and will cause relative coprostasis, followed by inflammatory and ulcerative processes established just above the stricture. Infection of the subjacent fresh scar, its breakdown, and the formation of a sacral fistula will be the result. These fistulæ show no tendency to spontaneous closure, and are a source of intense annoyance to the patient on account of the escape of fæces, gas, and mucus they readily permit. As, in most cases, their presence is caused by the existence of stricture, treatment must be first directed against existing strictures, the means being dilatation by laminaria-tents, by bougies, or, if necessary, by linear proctotomy followed by the use of bougies. All of these procedures must be surrounded by all known precautions insuring cleanliness and asepsis.

It will be found that a good number of secondary sacral fistulæ will readily heal shortly after the elimination of a rectal stricture, especially if the tract be stimulated to contraction by caustics or the thermo-cautery. In the more aggravated cases plastic operations will have to be resorted to for bringing about cure. If the fistula is near the anal aperture, the bridge of tissue may be divided as for ordinary fistula *in ano*, the fistulous tract excised, and the resulting wound sutured.

In the presence of an extensive defect, Kraske has performed with good success a complicated plastic, consisting in the superimposition of two cutaneous flaps, one turned with its epidermal surface towards the hollow of the rectum, the other serving to cover the former. Morestin found that generally the rectal mucous membrane extended far into the inner segment of the fistula, forming an infundibuliform lining, the presence of which is the cause of the failure of the simpler curative measures. He recommends an operation, tested by himself, consisting in the dissection of the constituent tissues of the fistula so as to enable the surgeon to suture the mucous membrane by itself, and to invert the mentioned infundibulum, projecting it into the rectal lumen. The tissues intervening between skin and the mucous lining of the rectum are treated as a separate plane, and are united by themselves; and this is followed by the suture of the integument.

As to the influence of sacro-rectal operations upon parturition, it will be interesting to bring forward Liliotsky's case published by Hochenegg,[1] in which a woman, having been operated on for rectal cancer by sacral resection, was delivered of child without any complication or accident. This is counterbalanced by another, less fortunate, experience mentioned by Morestin. A patient of Richelot, having undergone Kraske's operation for cancer of the rectum while pregnant, was to be delivered of child at the Maternité de Tenon. Parturition was normal, but the genital tract was infected by fæcal matter escaping from a sacral fistula which had come in contact with the accoucheur's hand, and the woman died of puerperal sepsis.

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[1] Loc. cit., No. 30.

# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, May 8, 1895.*

The President, Robert Abbe, M.D., in the Chair.

## THYRO-DERMOID OF THE COCCYX.

Dr. Francis H. Markoe again presented the man shown at a previous meeting with an immense thyro-dermoid tumor of the sacro-coccygeal region. An operation had been performed successfully for its removal, and the man's condition and appearance were in marked contrast with what they had been before the operation. The tumor which had been removed and photographs of the patient were also exhibited.

The patient was thirty-four years old, and had never been able to wear trousers on account of the tumor. There had been a doubt whether on removing it the anus could be made to occupy its normal position, as it was somewhat lower than it should be, but after the operation the rectum receded into the hollow of the sacrum and the anus was now in its normal position. No difficulty with defecation had been experienced at any time since the operation. The vessels at the end of the tumor were of considerable size and some hæmorrhage took place, but only from this part of the growth. The incision into the skin had healed primarily except at the drainage opening. There had been at the site of one retention suture, stitch infection, but incision and evacuation of the small pus-cavity soon resulted in healing. The patient had gained in weight and strength. The weight of the tumor was ten pounds. It contained a great deal of fat and gelatinous substance, and resembled the thyroid gland. Dr. Markoe said he had been able to find little literature on the subject.

Dr. McBurney said he had recently operated upon a case similar to that presented by Dr. Markoe. The tumor was much smaller, but it had the same pathological characters. Two prolongations made it difficult of removal. The coccyx, which the tumor had displaced backward, had become very movable and was removed, as it was evident that it would have proven an obstacle to sitting had it been left. Dr. McBurney thought the result of the operation in Dr. Markoe's case was certainly remarkable.

DR. ABBE showed a photograph of what seemed to be a similar tumor in a child six months of age. The patient passed out of his hands into Dr. Lange's, who had since removed the tumor, and the child had made a good recovery.

## OPEN TREATMENT OF ACUTE PHLEGMONOUS INFLAMMATION OF THE KNEE-JOINT BY A FREE TRANSVERSE INCISION.

DR. ARPAD G. GERSTER presented a child in illustration of a method of treating acute phlegmonous inflammation of the knee-joint. The method was suggested by Dr. Mayo, of Rochester, Minn., in the ANNALS OF SURGERY, January, 1895, p. 37. In the treatment of a comparatively large number of cases of acute septic inflammation of the knee-joint due to external infection, Dr. Gerster had found that the various methods suggested by surgeons for drainage of the joint have at times proven exceedingly ineffectual, especially in cases of sepsis, where drainage is most earnestly needed. The rules laid down by Andrews for making a series of lateral incisions he had found sufficient in cases of suppuration of the joint of sero-purulent character, not of phlegmonous character. But when he had employed such incisions, even in combination with very thorough and continuous drainage, in cases of phlegmonous inflammation they had proven ineffectual. The same had been true of apparatus recommended for fixation of incised and drained knee-joints. However ingenious the apparatus may be invented for immobilizing the joint, thus allowing painless manipulation and treatment of the wound, it had proven more or less ineffectual.

Dr. Mayo's suggestion struck him as very plausible, and he had applied it in two cases. The result had been excellent. As all know, these acute forms of joint phlegmon necessarily end in ankylosis, if, indeed, they do not cause loss of limb or life. The cartilaginous covering of the bones forming the joint is destroyed, and therefore ankylosis is inevitable. Knowing this fact, the surgeon in adopting this method of treatment frankly accepts the necessity for ankylosis. The road then becomes very clear. The treatment consists in laying the joint open by a transverse incision extending from one condyle to the other, just as a joint is laid open for resection. Then as many more incisions are made as may be necessary in order to open up every collection of pus or fluid in or about the joint. The capsule in all these cases is very intumescent and swollen, and for this reason occludes all drainage-tubes in a way to make retention inevitable. Then lay the joint freely open, removing or not removing tissue as the case may be, pack and drain every recess, and treat it as an open wound. It is astonishing how rapidly the phlegmonous process ceases when compared with other methods of treatment. After the symptoms of active inflammation have subsided, the joint is put up in proper position and ankylosis is allowed to take place.

The history of the particular case presented was as follows: A girl, eight years old, three weeks ago fell upon a knife while playing and sustained a punctured wound of the knee-joint; synovia escaped. On the fourth day the child had a severe chill and fever, and the knee became swollen and painful. The fever continued until the time of admission. On admission there was a defect in the integument over the quadriceps bursa, surrounded by very exuberant granulations. The joint was much swollen and reddened, and on slight pressure an enormous quantity of pus welled up out of the cavity. There were several places of fluctuation, especially one above the joint in the thigh, so that he had to assume that there was an abscess which did not empty itself into the joint and thus out through the opening referred to. The child was extremely emaciated, and under older precepts amputation would have been the proper step to be taken.

The girl was admitted January 21, 1895, with a temperature of 103° F. On that day she was anæsthetized, and he laid open the joint by transverse incision. In searching for abscesses he found a very large one above the bursa of the quadriceps, extending very high in the thigh, and two small abscesses in the popliteal space, which he incised through the transverse incision. The joint, being completely laid open, was flexed and packed with iodoform gauze. The temperature fell immediately, but exacerbations occurred every night, not, however, above 101° F. This he attributed to the fact of there having been considerable infiltration into the soft parts, without definite collections of pus, and after this had ceased to exist the temperature remained down. On March 3 some cartilage was found still present. It was scraped off to hasten ankylosis; the knee was extended and put in a fixed splint. The only drawback in the case has been a cicatrix of considerable size, which might have been obviated to some extent, and which may yet be remedied by a plastic arrangement of the retracted skin.

In a second case in which he operated in a similar manner, the patient being an older subject, he left the patella and paid more attention to the integument, with the result of having only such a scar as one sees after union by first intention.

The operation is one which is attended with very little danger, and in the case of this girl there is no doubt but what it has been life-saving, for she was extremely emaciated, and in all probability would have died, with or without amputation.

DR. MARKOE said that Dr. Gerster's first case, in view of an experience which he had had about four years ago, had interested him very much. A woman, twenty-two years old, had fallen down the steps of an elevated railroad station, striking the knee, causing a small lacerated wound directly over the patella and also a contusion of the joint. There was a great deal of distention without pus and without much fever. She was in one of the smaller hospitals of the city for several days, within which time the wound over the joint suppurated and led to infection of the joint. She was then transmitted to Bellevue, at which time the joint was enormously swollen, and the superficial parts were very red. There was a high temperature and chills. Dr. Markoe drained the joint by making lateral incisions on each side of the patella, one above and one posteriorly, which communicated with the lateral incisions. Improvement took place rapidly, and finally he succeeded in closing all of the wounds and obtaining motion to about three-quarters the normal extent. There was no erosion. It was the only case in which he had been able to obtain any respectable amount of motion after purulent infection of the knee-joint.

DR. HOTCHKISS recalled a case at Bellevue when he was on the house staff, Dr. Hall being the attending surgeon. The patient had been treated by the usual lateral incisions for acute suppurative inflammation of the knee with high fever, but improvement did not take place, and Dr. Hall then opened the joint freely, introduced the finger to break up pus-pockets, established free drainage, and succeeded in saving the patient's life and limb with ankylosis at the knee.

DR. ABBE remarked that there was a difference in the character of inflammations of the knee-joint. One form would recover with lateral drainage, while the other, a phlegmonous inflammation with septic infection, called for more radical treatment. A case of the latter kind had come under his observation last year. The patient had fallen, the knee became swollen, a doctor punctured it, thinking he would draw off a blood-clot. Septic inflammation followed, and when the patient entered the hospital the knee-joint was full of pus and plastic lymph, and was in very bad condition. Dr. Abbe opened it freely, washed it out, packed it with iodoform gauze, which he left in for forty-eight hours. The gauze did not come away as sweet as he had hoped it might, and the knee continued to suppurate, compelling him to resect the joint. Good union followed this procedure. There were some cases of phlegmonous inflammation of the joint in which this was the only procedure, short of amputation, which would save the patient's life. Dr. Abbe thought it was not necessary to open the joint above the patella in order to secure drainage, and it should be avoided in order to obviate an ugly scar which existed in the case presented.

## RUPTURE OF THE QUADRICEPS EXTENSOR TENDON.

Dr. Charles McBurney showed a patient illustrating the result after rupture of the quadriceps extensor tendon. The patient had ruptured both tendons at different times, and both times had been under Dr. McBurney's care. The rupture on the right side occurred two years and a half ago, in November, 1892. The statement of the patient is that he fell without direct injury to the quadriceps extensor tendon. In other cases which he had seen there had been a history of direct injury to the tendon while it was in a state of tension.

The operation was done immediately, and consisted in laying open the seat of the injury completely and then suturing the divided parts, very much as if it had been a case of fracture of the patella. Two heavy sutures were passed through the lower end of the tendon and the upper edge of the patella. The extensive rupture of muscle and capsule on either side was also sutured with catgut. The limb was put up in plaster of Paris. Primary union took place.

The second injury involved the quadriceps of the other side, the left, and occurred ten months ago. The same method of treatment was adopted, consisting in complete section of the superficial parts and suture of the quadriceps tendon to the upper edge of the patella. Passive motion and manipulation were begun at an early period,—the fourth week. He had great faith in the operation, having treated a number of cases by the same method with excellent results. When one cuts down and sees the injury, he has a better appreciation of the propriety of the procedure in cases where the rupture is complete and extends through the tissues on either side of the patella.

Replying to interrogatories, Dr. McBurney said there was a wide gap from retraction of the quadriceps before the operation. The man now had complete restoration of function and power. There was no restriction from adhesions. This latter condition, the freedom from adhesions, Dr. McBurney attributed to the use of simple sterile salt solution in washing the joint free from blood-clots, and to the early passive motions made.

Dr. Markoe said that he had, in 1888, treated a similar case of rupture of the quadriceps tendon in Bellevue by putting the leg up in plaster of Paris, as one would do in fracture of the patella, and had obtained a very good result, practically perfect. While there was distinct separation between the patella and the central portion of the tendon, the lateral fibres of the muscle had not been involved. The case had been reported in a paper by Dr. W. T. Bull, published in the *New York Medical Journal*, Vol. XLIX.

Dr. Gerster said he had within six months seen two cases of rupture of the quadriceps tendon. The first was in a tall stout man, about sixty-two years of age, who was pushed in getting off a car and fell, causing an oblique fracture of the femur and a subcutaneous division of the quadriceps tendon, the latter being due, Dr. Gerster believed, to cutting by the sharp edge of one of the fragments of bone. Replacement of the fractured bone was exceedingly difficult on account of muscular spasm. This was finally overcome by very profound narcosis. The patient was informed, after the fracture had been treated, that a second operation might be required on account of the division of the tendon, as it was not thought advisable to cut down upon it at the primary procedure. But when he reported again, after two or three months, the tendon was found absolutely normal and the function was excellent.

In the second case the accident occurred without external injury while the man was trying to save himself from a fall. Unlike in the first case, the rupture was not confined in the tendon, but apparently passed across into the fascia. He decided to cut down and suture the ends, and found that the upper extremity of the quadriceps tendon presented a ragged surface with projecting fringes of some length. The surfaces were smoothed, were brought together, and the result had been restoration to normal state. It seemed, then, that some cases required operation and some not, and he knew no criterion by which to decide positively which method of treatment to adopt, in certain cases.

Dr. Willy Meyer thought that if the patient were young and had rupture of the quadriceps tendon, an operation ought always to be proposed. If he were old and could not stand narcosis well, we might simply apply a splint and secure a good result. A personal experience with the latter method occurred in the case of a man of seventy-seven, who had ruptured the tendon on both sides from a slip while walking. Splints were applied, with the extremities raised, and from the first day massage was used. There was a very good result within six weeks, and he was walking very well at present. But Dr. Meyer thought an operation should have been done had the man been younger.

Dr. McBurney thought a careful distinction should be made between different cases. From the discussion, the conclusion might be wrongly drawn that all cases of rupture of the quadriceps tendon would do equally well without an operation. Dr. Gerster had said that we possessed no criterion, but the speaker, on the contrary, thought we possessed a clear indication when to operate and when not to operate. In Dr. Markoe's case, for example, the history pointed to rupture of the central portion of the tendon alone, while the lateral expansion was still attached to the patella, practically maintaining the parts in apposition. Such a case would get well without operation. But to conclude from it that cases with wide separation would do just as well without operative interference would be very unwise. Where one found separation clear across the joint, including the lateral portions as well as the central, operation was indicated.

Dr. Gerster said he agreed with Dr. McBurney, but it was not always easy to determine the extent of the rupture. It varied from the mildest to the severest form, which made it difficult to say whether the case belonged to the operative or the non-operative class. His remarks referred solely to this intermediate class of injury.

## HETEROPLASTY WITH CELLULOID INTERPOSED BETWEEN BRAIN AND SCALP.

Dr. Willy Meyer again presented a young man whom he had shown to the society some months ago in illustration of trephining for epilepsy, covering the cap with a piece of celluloid. The patient had been injured by a fall in Texas, in the summer of 1888. He was unconscious for a while, then became normal, and remained so for about a week, when convulsions set in. About four weeks after the injury he saw a physician, who trephined his skull with a small instrument, which resulted in leaving him well for six years. In July, 1894, he was again seized with convulsions, which were far worse than in the beginning. He entered the German Hospital, where Dr. Meyer, on July 9, 1894, reopened the original scar by a curved incision, reflected the flap back, and found the dura adherent to the periosteum and the brain protruding through a very narrow opening in the bone. It was as if one had to deal with a chronic strangulated hernia of the brain. The brain even kept its elevation after the bone had been removed, a distance of three to three and a half inches. A celluloid plate, thinner than what he desired to use because he could get no other at that time, was placed over the opening in the skull, and the skin was sewed over it, the patient being discharged with the wound healed on the fourteenth day. For about eight weeks the brain could be felt pulsating by placing the finger on the plate. Later the entire area showed firm resistance. The patient remained well after the operation until in the middle of last February, when, in the midst of his work in Texas, he was again seized with convulsions. The convulsions were far milder in character than they had been prior to the operation, but they came much more frequently, numbering over 100 in twenty-four hours at the time when he was again admitted to the German Hospital. The patient told him that he had not felt as well the day following his presentation to the society on the former occasion, and it was not unlikely that some of the gentlemen in examining the spot had made undue pressure over the piece of celluloid, which, in the first place, he had feared was somewhat too thin. On March 30 he again reflected the flap back and found on the top of the celluloid plate a thin, shining membrane, which was connected through two lateral slits in the plate, which had been made at the time of the first operation to permit of draining the wound, with a like membrane underneath. The plate was readily removed, and with a pair of forceps and scissors the lower membrane was peeled off the dura. The bone had redeveloped to almost its former extent, and again compressed and irritated the brain. This time he made the opening a little larger, three to four inches, using rongeur forceps, making a small step in the bone all round in which to rest the celluloid plate. This time a thicker plate was used, about one-tenth of an inch thick. The scalp was then sewed over the wound and healing had taken place in two weeks. There was one convulsion on the second day, but none had occurred since, and the patient felt that he was cured.

Dr. Meyer thought celluloid was superior to other material for closing the gap made in the skull, as it was durable, was smooth on both sides, and was easy to shape and to mould when warm. It is also very cheap.

## SUCCESSFUL OSTEOPLASTIC OPERATION FOR TOTAL DEFECT OF SHAFT OF TIBIA DUE TO ACUTE OSTEOMYELITIS.

DR. GERSTER presented a girl, six years old, who, seven months before her admission to Mt. Sinai Hospital, had been treated in the same hospital by Dr. Lilienthal for very extensive osteomyelitis of the diaphysis of the tibia, so that Dr. Lilienthal had to remove the entire shaft of the bone. The wound healed, but serious difficulty had since resulted by the child walking upon the fibula. Inasmuch as this bone had no proper *point d'appui* on the femur, it had become pushed up by the weight of the child until it projected two inches above the articulation to the remnant of the tibia. Consequently there was considerable shortening, and also inward rotation of the foot, so that the child was walking on the outer side of the foot, the plantar surface not touching the ground. No dressing or splint was able to give sufficient support. Dr. Gerster exposed the upper end of the tibia, which was buried in cicatricial tissue, and devoid of periosteal covering. This part of the tibia was utilized in an osteoplastic operation, but subsequent events proved this to be a mistake. Having exposed the end of the upper remnant of the tibia, he then cut down upon the fibula. This bone was found to have become thickened to four or six times its ordinary size, owing to the fact that it alone had been compelled to support the weight of the child in walking. He then divided the fibula at a height corresponding to the lower limit of the exposed upper tibial remnant. The interosseal ligament was then divided sufficiently to permit of the slipping through of the lower section of the fibula, so as to bring it into proper apposition with the upper end of the tibia. A simple dovetail was now made with the aid of a keyhole saw, and the parts were wired together. The bringing over of the lower half of the fibula to the tibia was seen also to correct very aptly the club-foot position of the foot. Unfortunately, about an inch and a half of the tibia necrosed, due apparently to having cut off its nutriment on separating it from the adherent cicatricial tissue. January 21, a second operation was undertaken, the intervening connective tissue between the bones was excised, the bones were again trimmed dovetail, were not drilled this time, but were brought together by wire wrapped around them. As before, the limb was again put up in a fixed splint and bony union now resulted. The shortening was two inches or more, but the child would be able to walk well with a high shoe. Dr. Gerster said he had obtained this method of treating such cases from the late Dr. Sands.

Dr. McBurney expressed appreciation of the admirable result of the method adopted in the case presented. He recalled a case of his own in which, after operation for osteomyelitis of the tibia with removal of the entire shaft of the bone and only partial reproduction, he utilized the fibula to fill in the gap, fastening the upper end of the healthy fibula to the outer side of the head of the tibia. Bony union resulted and the patient could walk, although the gap in the shaft of the tibia remained. The fibula had not undergone such great physiological increase as existed in Dr. Gerster's case, so that the limb was not quite as strong, and the patient subsequently wore an internal splint to strengthen the limb.

Dr. Abbe said there was a specimen in the museum of the College of Physicians and Surgeons of enormous thickening of the fibula which had been compelled to support the weight of the patient in the absence of the tibia.

Dr. B. F. Curtis mentioned the case of a man who had entered St. Luke's Hospital four years ago with severe compound fracture of the leg, resulting in necrosis and a gap in the tibia of about two inches. The fibula had also been broken and non-union had occurred in both bones. In order to fill in the gap of the tibia, he started to cut out a piece of the fibula about an inch long, insert it into the gap, and shorten the limb to this extent. He had first considered the operation described by Dr. Gerster, but thought the other method would give the patient a stronger limb. The operation proved successful in the end, but not exactly as he had intended, for, in attempting to cut out the piece from the fibula with the chisel, the bone fractured. The pieces, however, were pushed between the muscles into the gap in the tibia, being left in connection with the periosteum and soft parts as far as possible, the ends of the fibula were approximated by shortening the leg. At first only fibrous union resulted, but in the course of time the union became solid, with only about an inch shortening out of a gap of two inches, and the patient to-day was working as a guide in the Adirondacks, able to carry his own boat and to walk without a cane.

## THE TREATMENT OF TUBERCULOSIS AND NEOPLASMS OF THE BLADDER.

Dr. L. Bolton Bangs read a paper entitled, "The Relative Value of Operative and Hygienic Measures in the Treatment of Tuberculosis and Neoplasms of the Bladder." (See page 205.)

Dr. Abbe inquired of Dr. Bangs whether he deemed it advisable to treat tubercular lesion of the seminal vesicles and other portions of the genito-urinary tract beside the bladder by hygienic measures, and referred to a case reported by Dr. Weir, in which recovery followed removal through the perineum of tuberculosis of the seminal vesicles and vas deferens.

Dr. Bangs said he could not give a general answer to the question. For instance, he would not treat suppurating and painful tubercular testicle only hygienically, but would recommend the ordinary operations.

Dr. Willy Meyer thought everything depended upon an early diagnosis in tuberculosis of the urinary tract. In the first place, we had to consider whether we had to deal with an ascending or a descending tuberculosis. He believed the latter was much more frequent, and we should oftener avail ourselves of the use of the cystoscope in the early stage of the disease in determining the location of the lesion. If we would do this in every case as soon as hæmaturia was observed, we might oftener diagnose primary tuberculosis of one kidney and obviate further infection of the entire system by early nephrectomy. Long-continued irrigation of the bladder alone would naturally be without effect if the primary seat of the trouble was in the kidney. In a number of instances in tuberculosis of the urinary tract in the male, he had found direct catheterization of the ureters, after suprapubic cystotomy, to be of great help in determining the condition of each kidney. The ureteral soft rubber catheter had been left in place from twelve to twenty-four hours and the secretion of each kidney collected and analyzed separately. If the tubercle bacilli were found to come from one ureter alone, he thought the kidney on that side should be removed. The patient then had a chance to be cured. But even if the second kidney was slightly diseased by the ascending process, great improvement of the patient's condition might be secured by removing the primarily attacked suppurating kidney.

DR. MARKOE said that so-called primary tuberculosis of the genito-urinary tract was commonly secondary to tuberculosis elsewhere. He had performed suprapubic cystotomy in some cases without permanent improvement resulting. He had one case under observation of apparent primary tuberculosis of one kidney in which nephrectomy having been done two years ago, the patient was now in perfect health. Whatever operative procedure was resorted to, it should be supplemented by hygienic measures.

DR. ABBE called attention to the fact that the author of the paper had narrowed his subject to tuberculosis of the bladder alone, and had stated that the major lesions could be dealt with surgically. He, therefore, thought it might be well to limit the discussion to the hygienic and local treatment of tuberculosis of the bladder.

DR. GERSTER wished to state that, as in other forms of local tuberculosis which came under the treatment of the surgeon, so in tuberculosis of the bladder hygienic treatment was very important. He would not say that it was curative, for the reason that he did not believe a cure for tuberculosis had been found in the sense that all the tubercle bacilli in the system were destroyed. Even if one could make a prompt and positive early diagnosis of tuberculosis of one kidney, just as he might of some other diseases, by inspecting the surface of the body, he still would have a great deal of trouble in persuading the patient to submit to removal of the kidney. In tuberculosis of organs much more accessible, as of the testicle, he believed radical measures had been carried too far. Experience had taught him that a large number of tuberculous testicles could be saved. When we considered the great moral influence of the presence of the testicle, especially in young persons, he thought we would be justified in doing a partial operation only, and running the risk of leaving some tubercle bacilli embedded in the cellular tissue for a time or until hygienic measures could have time to complete the cure, rather than castrate the patient. Dr. Gerster had repeatedly dissected out the diseased portions of the epididymis and testicle and treated the wound by the open method, packing with iodoform gauze, and had obtained admirable results. The patients had been delighted to see the testicles saved, which, under the hands of other surgeons, would probably have been entirely sacrificed. He wished to endorse fully the position of Dr. Bangs, that hygienic treatment was of great aid to surgical treatment, and should never be neglected.

Dr. B. F. Curtis mentioned the case of a colored boy, about sixteen years of age, who entered St. Luke's Hospital suffering from very frequent and painful micturition. The urine contained little pus and little or no blood. A provisional diagnosis of tuberculosis of the bladder was made, suprapubic cystotomy was performed, and two or three small ulcers were found in the bladder and were scraped away. Drainage was continued for four or five months. At first the patient was not relieved, but he finally improved so as to be free from pain and able to hold his water two or three hours at a time. The case was rather interesting in the fact that the lesions were very small, yet the symptoms of pain and frequent micturition were very distressing. The improvement, so far as the bladder was concerned, remained permanent; at any rate, the distressing symptoms did not return, but the patient was found after six months to have advanced tuberculosis of the lungs, of which he died three or four months later. The case showed that a mild form of treatment was sufficient to enable the bladder to resume healthy function in spite of the fact that the constitution was still impoverished by tuberculosis elsewhere, and so far as it went it spoke rather in favor of mild measures in dealing with these lesions.

Dr. Bangs, in some closing remarks, said he had been careful to make use of the word cure only in the sense of abeyance, for when persons had once become inoculated with tuberculosis, they were liable always to have trouble, not only in the same organ, but also in distant organs. Surgical procedures, therefore, should only be undertaken after most conscientious consideration of the case, and with the understanding that there was liability to be a relapse and that hygienic measures should never be neglected. He had chosen bladder cases for discussion in order to draw out the opinions of the members with regard to diagnosis, which was sometimes difficult, and with regard to some other points. He would not now enter into the discussion of the treatment of general tuberculosis of the genito-urinary tract. He might say, however, that he was in the main in accord with Dr. Gerster regarding the treatment of tuberculosis of the testicle.

*Stated Meeting, May 22, 1895.*

The President, Robert Abbe, M.D., in the Chair.

## ACUTE CIRRHOSIS OF THE LIVER IN A BOY OF SEVEN YEARS.

Dr. Abbe presented five specimens. The first was a small, cirrhosed liver of a boy seven and a half years old, without alcoholic history. The boy had been brought to him from up in the State, with a history of having had ascites for two months without previous illness. His appearance was that of a delicate but not unhealthy boy. There was no history of alcoholic habit on the part of the parents of the boy. There was no history of syphilis, nor evidence of tubercular disease. Dr. Abbe's first suspicion was of tubercular peritonitis. Exploratory laparotomy was performed. The peritoneum was found normal. On further search it was found that the liver was in the condition of the so-called "hobnail." It was extremely small, cirrhosed, and nodular. A large collection of ascitic fluid was evacuated and the wound closed. The ascitic distention occurred again after two weeks. A small opening was then made and iodoform gauze was introduced to facilitate drainage. The patient had no fever and did well for two days, then died of cardiac syncope. There had been no evidence of cardiac disease. The liver, obtained post-mortem, showed the condition described.

## STRANGULATED HERNIA; RESECTION AND ANASTOMOSIS WITH MURPHY'S BUTTON; DEATH FROM KINKING AND STRANGULATION DUE TO THE WEIGHT OF THE BUTTON.

The second specimen presented by Dr. Abbe consisted of the resected portion of gut from a case of strangulated hernia. The patient, aged about forty years, had had acute strangulation of a right inguinal hernia of about three days' standing. The strangulated portion was gangrenous under the constriction. Consequently a portion was resected, five inches in length, and anastomosis made with Murphy's button. It was evident from an examination of the specimen that the inner and muscular layers were gangrenous, the peritoneal coat alone maintaining the shape of the gut when distended and preserved in alcohol. The specimen, forty-eight hours after anastomosis, showed that no leakage had taken place around the button, and that there was good union. After completing the anastomosis he replaced the loop containing the button and proceeded to do Bassini's operation. Before closing the wound entirely he looked in and noticed that the proximal end of the gut was still distended. This was due to the button kinking the gut as it lay upon the extreme right of the iliac fossa so that the contents could not move along. He therefore pushed it towards the middle of the abdomen, thinking it would settle and rest easily among the other coils. But the patient had no movements, severe symptoms of strangulation recurred, and at the end of forty eight-hours after the first operation Dr. Abbe reopened the abdomen in the median line and found that the cause of the obstruction was a kink in the gut at the site of the button, which had gravitated to the lowest point in the pelvis. The man's condition was then so bad that he was expected to die on the operating-table. He survived the operation a short time. It seemed that the weight of the button itself had given rise to the acute obstruction by sharply bending the gut.

Dr. Rushmore asked Dr. Abbe on which side of the button was the kink in the case of intestinal anastomosis, and Dr. Abbe replied on the distal side. Dr. Rushmore thought the condition must have been due to paralysis of the gut. It would seem that if the muscular coat had not been paralyzed it ought to have been able to force the contents through. He had seen, as doubtless all the other members had, obstruction and death follow operations on the gut when there was no peritonitis, no sepsis, no other apparent cause than paralysis of the intestine.

## GALL-STONE REMOVED FROM THE COMMON DUCT.

The third specimen presented by Dr. Abbe consisted of a gall-stone removed from the common duct near its junction with intestine in a patient who had been deeply jaundiced for two months. He incised the duct, removed the stone, sewed up the wound, primary union followed, and the patient made a rapid recovery.

## SYPHILITIC ENLARGEMENT OF THE LIVER; EXPLORATORY LAPAROTOMY; RECOVERY UNDER MERCURIAL TREATMENT.

Dr. Abbe presented illustrations of a fourth specimen, consisting of syphilitic nodules of the liver. The woman had been operated upon at the Woman's Hospital for pus-tubes, as she was told, some months before Dr. Abbe saw her. Following the operation, and before she left the hospital, she had elevation of temperature, hectic, and great enlargement of the liver and spleen was discovered. She said she was told they could do nothing more for her; that it was not probable she could recover. It seemed probable they regarded the case as one of cancer of the liver, and this was also Dr. Abbe's first impression. She was slightly jaundiced, the liver and spleen were very much enlarged and nodulated. Every afternoon the temperature rose to 102° F., and she was failing rapidly. His second impression was that there might be an hepatic abscess, but aspiration failed to discover pus. Finally he made exploratory laparotomy, more particularly to learn whether there was not a deep-seated abscess. He found no abscess, but the liver was enormously enlarged and was studded with tumors from the size of a bean to an inch in diameter. There were also some crater-like scars on the surface of the organ. It did not look like cancer, but rather like syphilis, and he therefore took out one of the tumors nearly an inch in diameter at the free edge of the organ, first ligating about it in sound liver tissue by a chain of stitches. The spleen was also found greatly enlarged. The external wound was closed without drainage. Dr. Thatcher examined the specimen and reported that it was a syphilitic gumma. The patient was then treated by mercurial inunctions, whereupon she made a rapid recovery; the temperature disappeared, her pains left her, and she gained in strength and twenty pounds in weight. Now, after three months, she remains in perfect health.

## RUPTURE OF THE TENDON OF THE ADDUCTOR LONGUS.

Dr. Abbe presented photographs of a fifth case, showing a tumor in the upper and inner part of the thigh of a man. The patient, while riding, had been thrown upon the pommel of his saddle, striking the inner and upper part of the thigh, making a large extravasation. A fluctuating mass was found below the pubes on the inner aspect of the thigh which, when he attempted to adduct the leg, immediately bunched itself into a harder mass. It was the adductor longus muscle which had been torn away from the femur and on contraction drew up towards its pubic attachment. When Dr. Abbe saw the patient he was suffering no inconvenience from the mass, and nothing was done.

DR. W. W. VAN ARSDALE was reminded by Dr. Abbe's case—rupture of the adductor longus muscle—of one of rupture of the biceps in the arm seen by him last summer. The rupture occurred in the tendon just below its insertion into the muscle, and since the man was incapacitated by it he suggested that the ends be sutured. The patient's employer, however, refused to have it done, and another surgeon was seen who advised that it be let alone for further observation. The man had now lost complete function of the muscle, could only do light work, but was being retained by his former employer, who, probably, had some qualms of conscience.

About two months ago he had seen a case of rupture of the pectoralis major treated by suturing by Dr. Gerster. The first and second attempts were said to have failed, but the third resulted in restoration of the function of the muscle. Dr. Van Arsdale thought that, in traumatic rupture of muscles, some good would come from securing the divided parts by sutures.

DR. CURTIS remarked that the muscles of the abdomen were always sutured after transverse incisions and union and restoration of function was obtained. There was no reason why suturing should not be successful after traumatic rupture of muscles. The cases which he had seen had only been of one head of the biceps, so that function was not greatly interfered with. He had recently read of a case in which a French surgeon had cut down on the ruptured long tendon of the biceps, removed the tendinous portion, then sutured the muscle to the short head and secured a good result.

DR. ABBE saw no reason why the operation should not be done, provided there was disability. In the present case there was no special disability, and if an operation were undertaken it would probably be difficult to get attachment to the femur, for the muscle had been stripped off the entire length of its attachment to the middle third of that bone. It might be sutured to the adductor magnus and made to work with it. He was sure, however, that a good functional result might have been obtained for the ruptured muscle had it been sutured early.

## METALLIC CAP OF LEAD-PENCIL COUGHED UP FROM BRONCHIAL TUBE.

Dr. F. W. Murray presented the metallic end of a lead-pencil, about three-fourths of an inch long, which had been coughed up from a bronchial tube by a boy seven years of age. The boy had been in the habit of going about with the end of the pencil in his mouth, and one night—while running up-stairs—was suddenly taken with choking and dyspnœa and became very blue in the face. The family physician was sent for, but before he arrived the boy had entirely recovered, and only complained of some irritation in the laryngeal region. A throat specialist, in the neighborhood, was called in by the family physician, and, after a careful examination of the pharynx and larynx, could find no signs of the foreign body. On examination of the chest, the foreign body was thought to be located in the left bronchus. The next morning the boy was sent to St. Luke's Hospital and came under Dr. Murray's care. On admission the boy asserted that he felt perfectly well. He had no pain, no cough, no dyspnœa, and examination of the pharynx and larynx by means of the mirror was negative.

Percussion gave natural resonance on both sides of the chest, and there was no difference between the two sides in expansion on inspiration. On auscultation over the left lung, there was entire absence of respiratory murmur in the upper and middle thirds and diminution of respiration in the lower third. No râles could be heard. The diagnosis of foreign body in the left bronchus was made, and it was evident that it was fixed. As the boy was perfectly comfortable it was decided to wait, and in case threatening symptoms should arise to perform a low tracheotomy. That evening the boy had a sudden attack of coughing of very short duration, during which the end of the lead-pencil was expelled, the house-surgeon immediately examined the left lung and found that respiratory murmur was present in the regions where in the morning it was absent. The outcome of the case was certainly very satisfactory.

Dr. Murray believed it was not unusual for foreign bodies lodged in a bronchus to be coughed out, particularly after tracheotomy had been performed.

Dr. F. Tilden Brown inquired whether the practice of invert-ing the patient with foreign body in the bronchus was effectual, cough being induced at the same time.

Dr. Rushmore thought the success of efforts to make the patient cough and dislodge the foreign body in the bronchus would depend somewhat on the completeness of the closure. If the bronchus was entirely closed, so that no air could get behind the foreign body, it was useless, he thought, to try to dislodge it by having the patient breathe deeply, by coughing, etc. To pound the patient on the back and to resort to the various other measures for the purpose of dislodging the foreign body seemed to him rather a dangerous procedure before tracheotomy had been performed, for the foreign body might reach and remain in the larynx, and cause death before the trachea could be opened. It was best to do tracheotomy first, and then if the foreign body became dislodged it would come out through the tracheal opening, or, if it entered the larynx, it could be easily removed.

These points had been strongly impressed upon him by a case seen by him two or three years before. In that instance, too, the fact was clearly demonstrated that through the tracheotomy wound one could easily feel the bifurcation of the trachea with the finger, especially when the patient coughed, enabling the operator to thus explore the entire trachea.

In cases of foreign body in the bronchus, the operation suggested by Näseloff was a simple one, and would probably be attended by no trouble unless it were arterial hæmorrhage. He could not speak on that point because he had only done it on the cadaver. It consisted in dividing in the left side the third, fourth, and fifth ribs behind, pushing the pleura to one side, whereupon the bronchus would be seen and readily attacked. He would never think of again trying to do the operation which he attempted in his case, entering the thorax anteriorly. It was very difficult even after one had entered the thorax, and the presence of old pleuritic adhesions would complicate the operation.

# EDITORIAL ARTICLES.

## BAUBY ON THE TREATMENT OF SURGICAL TUBERCULOSIS WITH HOT WATER.[1]

This new method of treating suppurative tuberculosis by means of hot water was instituted by Jeannel, of Toulouse, and designated by the term *ébouillantement.* Within the past year he read a paper upon the subject before the Académie de Médecine de Paris. Since that the use of this therapeutic measure has been continued and a large number of cases added to the last statistics.

The modern tendency of surgical therapeutics is in two different directions, but which have in view the same object. One method which belongs to the era of asepsis consists in attacking and extirpating all signs of the disease. This is often bold and hazardous. The other method consists in sacrificing as little tissue as possible, in a limited operative intervention and in preserving intact the function and form of the part.

Formerly, the cases of local tuberculosis were practically left to their fate to recover spontaneously or to die. A cold abscess was allowed to go on suppurating. White swelling was only treated by amputation when that extreme measure became necessary. Now we see tuberculous foci exposed in the most remote places, in the peritoneum, in the articulations, and in the medullary canal. This is the result of aggressive surgery. But when the operator comes down upon the lesion itself, he occupies himself with preserving the important structures.

Under the influence of these general principles early resections are taking the place of late amputations. Unfortunately, a skilful and judicious operation does not always crown these early efforts with the desired success. Sometimes recurrence of the disease takes place at the seat of operation; and often suppuration retards the healing process.

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[1] Bauby (Toulouse), Traitement des Tuberculoses chirurgicales par l'Eau bouillante, Archives Provinciales de Chirurgie, T. III, No. 9, 1894.

In order to avoid these complications and to obtain quick healing, as in other operations, not only the easily-accessible infective tissue must be removed, but also the remoter colonies of bacilli must be attacked. With the ordinary cutting instruments of the surgeon this is almost impossible. An excision of all visible disease, a dissection of the fungosities, or a thorough curetting have to be done to effect a cure.

It has been the endeavor of all time, since the discovery of the bacterial cause of tuberculous inflammations, to find some surgical procedure or some remedy or means by which the whole lesion might be destroyed.

At the present time there are two methods for combating surgical tuberculous disease practised,—the chemical and the physical. The chemical method operates by causing a change in the tissues or by acting directly upon the microbes themselves. The chloride of zinc is an example. It is used in various ways, either in weak solution or in a concentrated form. It is injected into the tuberculous cavities with the view of killing the bacilli and hastening cicatrization, or it is injected into the boundary of sound tissue for the purpose of causing sclerosis after the method of Lannelongue.

The use of iodoform is in high credit. It has been regarded almost as a specific. Used as a powder, in emulsion, or in solution it has certainly given some good results. The mixture of iodoform and ether merits especial notice, because of its value due to its diffusibility.

Naphthol-camphor, tincture of iodine, and other products have been used with various degrees of success in the hands of various practitioners. All of these chemical agents possess incontestable merit, and the author does not purpose to discredit them.

It is wise to have in mind their inadequacy. They all act superficially; or if they do penetrate the diseased tissue, their action does not, as a rule, extend as far as the limit of the disease; and the active element and propagator of the disease continues its action centrifugally from the centre of the nodule or tuberculous abscess. If these peripheral colonies are not exposed, the chemical agents do not reach them.

The agents which act physically are used to obtain the same results. Heat constitutes the most effective means of destroying infective germs. For sterilizing contaminated objects, instruments, and culture media, dry or moist heat is used in some of its various forms in laboratories and in general practice.

From the point of view of the special sterilization of wounds, and particularly tuberculous wounds, dry heat has been used for a long time. The red-hot iron of the ancients, replaced by the thermocautery, is much used at the present time, and is frequently employed to destroy fungosities and to affect the disease in pathological tissue. But this method has but a superficial action. Beneath the carbonized layer in which the microbes and animal cells are immediately destroyed, the living tissues are but little changed. The frequent recurrences, the continuous progress of the disease, demonstrate that the tuberculous process is not always checked by cauterization.

A method more efficacious than this must be sought for. Félizet invented the plan of carrying a high temperature into the tissues by means of a blow-pipe flame. This is a very ingenious idea, but its application was rather difficult. To use a homely comparison, it was like broiling a bloody steak, the outside being affected, but the deeper tissues remaining unchanged.

How much more thorough is the action of hot water. With this it is easy to judge when a sufficient degree of heat has been applied, and thus to avoid the accidents of burning. Instead of the carbonization of the tissues, as is caused by dry cauterization, and instead of forming a superficial protecting layer for the subjacent tissues, moist heat ramifies and penetrates the tissues, and the heat is carried deeply into the seat of the disease. In just this manner foods are cooked and sterilized throughout their entire thickness. When the process of sterilization has gone far enough it can be easily stopped, and thus regulated.

Hitherto the properties of moist heat have not been made use of in therapeutic surgery. Jeannel was the first to think of this plan. He applied his remedy to cold abscesses, which had opened spontaneously or which had been incised, and to infected wounds. The results obtained by the first experiments were eminently satisfactory, and led him and Bauby to continue the practice in a large number of cases.

Before proceeding further, Jeannel wished to make a few experiments upon animals to establish his treatments upon a more scientific basis.

He placed a dog under anæsthesia and exposed the muscles of the buttocks. A thermometer was placed deeply beneath the muscles on one side and the tissues subjected to *ébouillantement* in the same manner and for the same length of time as for a supposed diseased condition. The thermometer rose six degrees,—from 36° C. to 42° C.

The other muscular surface he treated by cauterization with the thermo-cautery at a red or white heat, and much more energetically and for a longer period of time than is practised clinically. The thermometer rose but half of a degree, and a part of the surface of the muscle was absolutely carbonized. The thermometer was placed twenty millimetres from the surface in the first side, whereas in the other side it was but eight millimetres below the carbonized surface.

A repetition of experiments showed that the influence of the thermo-cautery was felt through a muscular thickness of but four millimetres. Other experiments showed that the muscle was affected by *ébouillantement* to a depth of six millimetres, whereas the thickness of muscle roasted by the thermo-cautery was not more than three or four millimetres.

All of these differences speak in favor of the moist heat. It is then, therapeutically, more penetrating than dry heat and gives a greater variation in the degree of heat. As is known in the laboratories, it takes a much longer time and a higher degree of heat to sterilize by dry heat than by moist heat.

The problem in the sterilization of a tuberculous wound is as follows:

(1) 80° C. of heat are required to destroy and render inert the toxines of the bacteria.

(2) A temperature of 100° or 110° C. of moist heat destroys the germs, and is as effective as 600° or 1600° C. of dry heat, the effect of the former being felt much more deeply and acting more surely.

These, then, are the principles upon which the treatment of surgical tuberculosis by means of boiling water is based.

The application of the method requires some delicacy and prudence, because it is doubly dangerous on account of the energy of the caustic action and the diffusibility of the heat.

It is scarcely necessary to say that anæsthesia should be complete. *Ébouillantement* of the wound would otherwise be very painful. It is conceivable that, under certain circumstances, a small abscess for example, a little cocaine would suffice. In almost all cases general anæsthesia will be necessary.

The tuberculous focus should be evacuated of its pus, the caseous and fungous substances should be thoroughly sponged. Hæmostasis should be perfect. This is indispensable because the heat coagulates the blood over the surface to be affected, and prevents the penetration of the hot water.

This method of treatment may be applied in two very different ways, depending upon whether the hot water is introduced immediately into the pathological cavity or whether the temperature of the water which is introduced is gradually increased. In the first case the boiling water may be rapidly applied to the wound by bringing in immediate contact with it tampons or sponges from the water. This primitive procedure may easily result in a burning of the healthy tissue, and the skin in particular. This accident can, of course, be prevented by surrounding the area to be treated by compresses saturated with cold water. Or continuous irrigation with cold water may be practised about the wound. The combination of these two methods offers extra security from burning the sound tissue.

This was the original method of Jeannel and Bauby. They found that for general purposes this simple apparatus sufficed, and it contributed to many of their cures. Yet they have now almost entirely abandoned it.

The tampons offered many inconveniences. The water with which they are impregnated becomes rapidly cooled. It loses much of its heat simply in the transportation from the kettle to the wound. One is not able to estimate exactly the quantity used nor the degree of its penetration. It may burn the surrounding skin in spite of the precautions above referred to. The authors were, therefore, compelled to devise some other plan.

They now turn the water directly into the wound, the edges being held open by forceps. The water is conducted from a special vessel by means of a tube. In general practice it is easy to procure for this purpose a tea-kettle with a long spout, which answers very well for this purpose. The modern samovar answers most admirably for this purpose; by means of the stopcock at its lower part it permits of exact regulation of the flow of water. This is an apparatus analogous to that which they employ in their hospital work. They use a sort of copper coffee-pot, having at its base a stopcock, to which a rubber tube is attached. At the other end of this tube is attached another small stopcock. To this is attached an isolated handle for holding the tube without burning the hand. This coffee-pot is filled with salt water, and is placed over a gas or alcohol fire.

After having allowed the first water to flow out of the tube so that it may become warmed, the stream is directed into the wound in the exact quantity desired.

This is a douche of hot water which can be controlled and regulated at pleasure. When the cavity is filled, the water is sponged out; and the process can be repeated until a sufficient action has been obtained. A characteristic gray coloration of the tissues is observed at once as a result of the heat. This is the first kind of *ébouillantement.*

The second method is quite different. It consists in heating in the wound itself water which is introduced in a cold or tepid state. This is accomplished by plunging into the water the point of the thermo-cautery, kept constantly at a red heat. The time required for heating the water to the boiling-point depends upon the size of the cavity filled; but it is always very quickly accomplished. For an abscess cavity, for example, the size of a pigeon's egg, one minute abundantly suffices. The water begins to boil, takes on a greenish-gray color, becomes covered with froth, and rapidly evaporates, leaving the cavity almost entirely empty.

The walls present the same greenish-gray appearance, and are apparently cooked. It is well to repeat this operation four or five times to obtain a good result.

It is very evident that this is the best method of proceeding, inasmuch as one part is certain to reach a temperature of 100° C., and the other part is not in danger of being burned.

This method cannot be used under all circumstances. The wound cavity may be too deep and tortuous, or there may be counter-openings so that the cavity will not hold water.

The authors have under consideration the therapeutic properties of moist heat in the form of superheated steam. They have attempted its use in practice, but unfortunately this vapor, such as is generated in the autoclave, for example, cools down so very rapidly in the air as to render its use thus far impracticable.

Salt water at a temperature of 105° C. they find to be the best for the purpose. It is easily prepared, and its infiltration into the tissues is very active, but it cools very quickly. This inconvenience can be avoided by using in place of water some fluid which has a high boiling-point, evaporates very slowly, and which retains its heat for a long time. Such fluids are oil and glycerin. Phocas, of Lille, has used boiling oil in this way with great success. The use of oil has seemed rational to the author, but because of its disagreeable odor he has not employed it. It is also objected to because it penetrates the tissues very slowly.

Once Bauby employed glycerin in a small tuberculous abscess of bony origin. Though the case recovered, the success was not an encouraging one. He observed that the boiling-point of the liquid was very high, and that the absorption of the fluid by the tissues was very much inferior to that of salt water.

To appreciate the exact value of the observations which are presented in the following paragraphs, it is well to know that the treatment by *ébouillantement* was accompanied with dressings of the wounds with aseptic materials sterilized in the autoclave of Sorel and not with antiseptics. This precaution was necessary in order to judge the good effects of the method, for had the wounds been dressed with iodoform, sublimate, or carbolic, it would have been difficult to decide to which the cure was due.

The wound treated by hot water gives rise to an abundant serous secretion which impregnates the dressings and necessitates their frequent renewal. The notable peculiarities in their appearance is always very evident. After a few days there is manifest an active growth of new tissue. The cheesy centres take on the character of a perfectly healthy, clean wound. Suppuration is but very slight; and the repair is rapid. In certain cases immediate union has been obtained.

Bauby and Jeannel have reported a large number of cases treated by this method. They classify their cases into four groups, tuberculosis of the soft parts, tuberculosis of bone, tuberculosis of articulations, and visceral tuberculosis.

Their work may, perhaps, be said to lack scientific accuracy. They are open to the reproach of not having established, upon the basis of rigorous bacteriological examinations, the nature of the lesions which they treated. They did not affirm the presence of the tubercle bacillus before the operation nor its disappearance afterwards. In a word, they neglected the *contrôle du laboratoire*. Such objections are perfectly just. Their work has, however, been eminently practical, and their efforts have always tended more towards the perfecting of the technique than to theoretical demonstrations. Yet it is true that the discovery of the microbe of Koch is not absolutely necessary in order to diagnose tuberculosis. Their experiments show that the hot water simply destroys all of the infectious germs, and among these is the bacillus of tuberculosis.

Most all of the cases reported by them are cases of pretty grave local lesions. Most of the cases would have been regarded by surgeons as subjects for radical operation, and not for such conservative treatment as they received. The results were eminently satisfactory in the cases which they have reported.

The seven cases of tuberculous abscess of the soft parts healed perfectly. The process of cicatrization was very rapid, and the resulting scar but slight. It is true that when a cold abscess is opened and curetted it usually heals, if the conditions are favorable. Jeannel and Bauby have not only always secured healing without recurrence, but they have on occasions secured primary union.

They treated four cases of osteitis with four cures. Here also, as in the simple abscesses, the results were very happy ones. The osseous cavities filled up without suppuration. It may be very properly asked whether the osteogenetic power of the periosteum is not impaired by the penetrating heat of the water. This can be answered in the negative, for an opportunity was offered in one of their cases of making a dissection of the parts, and it was found that a firm and solid osseous growth had filled the defect.

Tuberculosis of articulations is represented by nine cases, in which the results were very much the same. Aside from the results which were good,—which were, indeed, remarkably good,—there were a few less satisfactory cases. These failures were of two sorts. One was in a resected hip-joint. The treatment by *l'ébouillantement* was not thorough and complete, because it did not reach the deeper part of the suppuration which was in the iliac bone. The intervention was intentionally palliative, and it gave as good a result as could have been expected.

The other case was quite different. They operated with the view of obtaining a perfect cure, but through a fault in the technique the very opposite result was brought about. In two cases there was an osteo-arthritis of the tibio-tarsal joint which most surgeons would probably have treated by amputation. Resection was done with the accessory treatment by *ébouillantement*, and gangrene of the foot resulted. The accident was unquestionably due to the hot application. This inopportune heating of the posterior tibial nerves and vessels, poorly protected as they were, caused a coagulation of blood in the vessels and a profound disturbance of the trophic function of the nerves. One of these cases terminated in death and the other in secondary amputation. These are accidents which by proper precautions can be easily avoided.

*En résumé, l'ébouillantement* offers, in the opinion of Bauby, a method superior to all others for the sterilization of tuberculous foci. Its action is energetic and far-reaching. It penetrates and traverses the tissues containing the bacilli, and greatly modifies the condition of the vitality of the parts. In circumscribed abscesses in bone, connective tissue or gland, its efficacy is a demonstrated fact. In the more extensive, complex, and irregular lesions the results are most encouraging.

James P. Warbasse.

## THE ASEPTIC TREATMENT OF ABSCESSES AND SUPPURATING WOUNDS.[1]

THE pendulum continues to swing backward, and antiseptics continue to be discarded on every hand. First the spray was abandoned; then the instruments were not immersed in antiseptic fluids; at about the same time antiseptic dressings began to be discarded; and, finally, antiseptic irrigations are being dispensed with. The past five years have seen antisepsis give place largely to asepsis. The question, shall fresh wounds be treated with antiseptics? has been pretty generally answered, No; and a question which may now very properly be asked is, Shall infected wounds be disinfected?

Zeidler,[2] in making a negative reply to this question, calls attention to the work of Schimmelbusch,[3] which proves that the value of disinfection is at least very questionable. Reichel[4] and Hänel[5] have arrived at the same conclusion, while, on the other hand, Henle[6] and Messner[7] found otherwise. More recent experiments seem to show that almost every sort of wound disinfection is contra-indicated.

Reichel made a number of experiments upon animals and found that he could best check extensive phlegmonous processes by free incision into the infiltrated tissue, and that a disinfection of the wound was of absolutely no advantage. During the course of the past two years he has treated a large number of cases of suppuration without any disinfection of the pus-cavity. The pus was liberated by free incision, the cavity sponged out, and tightly tamponned with iodoform gauze. His results have been excellent.

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[1] Read before the Alumni Society of the Seney Methodist Hospital, Brooklyn, May 20, 1895.

[2] Centralblatt für Chirurgie, No. 14, 1895.

[3] Ueber Disinfection septischer Wunden, Verhandlungen der deutschen Gesellschaft für Chirurgie, XXII Kongress, 1893.

[4] Zur Aetiologie und Therapie der Eiterung, Archiv für klinische Chirurgie, Bd. XLIX, Hft. 3, 1895.

[5] Zur Frage der Disinfectionsfähigkeit der Wunden, Deutsche medicinische Wochenschrift, No. 8, 1895.

[6] Ueber Disinfection von frischen Wunden, Verhandlungen der deutschen Gesellschaft für Chirurgie, XXIII Kongress, 1894.

[7] Experimentalle Studien über die Wundbehandlung bei inficirten Wunden, Verhandlungen der deutschen Gesellschaft für Chirurgie, XXIII Kongress, 1894.

The aseptic treatment of suppuration is not new. The practice here, as is often the case, precedes the experiments. Senger,[1] in 1888, limited antiseptics to simple suppurating wounds. In 1889, Zeidler[2] wrote upon the treatment of suppurating wounds without the use of antiseptics. At that time he reported a hundred cases of all sorts of suppuration; and in 1892 he reported several hundred cases of suppuration, from granulating surfaces to extensive phlegmons, treated without antiseptics.[3] In the same year Helferich appeared with a report of cases of phlegmon treated in the same way. In the recent hand-books of Schimmelbusch,[4] Braatz,[5] and Jaffé,[6] irrigation with carbolic and bichloride solutions in suppurative processes is regarded as superfluous and harmful.

Theoretically, it seems also to be recognized that not only in aseptic but also in infected wounds antisepsis is being replaced by asepsis. In practice this feeling is not entirely dominant. Many disciples of asepsis for clean operation-wounds disinfect their suppurating wounds with antiseptic agents. For the benefit of these, Zeidler's experience and observation in a large number of cases may be briefly mentioned.

In the Obuchoff Hospital in St. Petersburg, in the year 1892, 956 operations were done for abscesses, suppurative lymphadenitis, suppurative bursitis and tendosynovitis, parotitis, carbuncles, etc. In

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[1] Ueber die Gefahren und die Leistungsfähigkeit der modernen Wundbehandlung, Berliner Klinik, 1888, Heft 6.

[2] Zur Frage der aseptischen Wundbehandlung, Wratsch, 1889, Nos. 32–34 (Russian).

[3] Bakteriologische Untersuchungen von Verbandmaterial, Bolnitschnaja Gazeta, Botkina, 1892, Nos. 35–37 (Russian).

[4] Anleitung zur aseptischen Wundbehandlung, Berlin, 1892.

[5] Die Grundlagen der Aseptik, Stuttgart, 1893.

[6] Principien und Technik der heutigen Wundbehandlung, Medicinische Bibliothek, Leipzig.

1893, 1165 similar operations were done; and in 1894, even more than this, including osteomyelitis, suppurative peritonitis, perityphlitis, and empyema. In these cases antiseptics were not employed. The operations were done in the following general way: The field of operation was prepared after the usual rules. During and after the operation the wound was simply sponged out with sterilized gauze. As a rule, irrigation was not used. When irrigation was resorted to, normal salt solution (0.6 per cent.) was employed. The wound was then very carefully and tightly packed with sterile gauze. Over this was placed a layer of gauze and then sterile wood-wool, moss, or other absorbent material.

At dressings, the skin around the wound was cleaned with ether or benzine, and the granulating wound irrigated with salt solution, dried, and dressed with sterile gauze. In most cases a dry gauze dressing is preferable. In some wounds, of course, a wet dressing is indicated. When this is necessary, the gauze and cotton covering are simply moistened with salt solution. A large experience with parallel experiments has convinced Zeidler that it is the moisture of the dressing that is of benefit and not the antiseptic, as Reichel assumed. Zeidler has not been able to discover any difference between moist carbolic, bichloride, and salt dressings. There seemed to be some slight effect from the dressing of clay soaked with acetic acid, but this was probably due to the astringent effect of the same. He has never seen any advantage derived from dressing suppurating wounds with iodoform gauze.

Numerous bacteriological investigations of suppurating wounds immediately after their disinfection have always shown pus cocci. With some few exceptions, Zeidler's experience with antiseptic dressings has been the same as that of Schlange.[1] He has never seen an antiseptic dressing have any retarding or disinfecting effect upon the bacterial development.

His results in the aseptic treatment of suppuration are throughout satisfactory, much better than are obtained with the energetic use of antiseptics; and his clinical observations corroborate the experiments made by Reichel upon animals.

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[1] Ueber sterile Verbandstoffe, Verhandlungen der deutschen Gesellschaft für Chirurgie, XVI Kongress, 1887.

The local progress of the wound is better; the amount of secretion is less; and the development of granulations goes on normally, and the granulations do not become excessive or show the tendency to bleed that we are accustomed to see in wounds treated with iodoform gauze.

Even when the dressing is not often changed,—often being left on eight days,—no strong odor is observed or any decomposition of the secretions.

So long as a free escape of matter is provided for, the healing of the wound goes on normally; and it is claimed that there is much less reaction in the wound treated aseptically than when antiseptics are used.

The important indications in the treatment of suppuration are free opening and free drainage; and in the opinion of Zeidler a disinfection of the wound is not only not indicated, but is dangerous.

These observations from other sources suffice to illustrate the aseptic treatment of suppuration. In the treatment of the superficial suppurations of certain mucous surfaces, the value of antiseptics seems to have been pretty well demonstrated. The resisting capacity of epithelial cells against chemical irritants is much greater than that of connective-tissue cells; and it is perfectly possible to apply to a mucous surface germ-destroying solutions which do not impair the vitality of the native cells. The conditions which exist here are so very different from those existing in a wound or abscess that these remarks have been confined to connective-tissue suppurations.

By the antiseptic treatment we understand the use of antiseptics as they are ordinarily employed. The cauterization of wounds either by actual heat or by strong and corrosive chemicals, is often a valuable surgical measure, but cannot in the usual sense of the word be included in the antiseptic treatment. Nor should wounds which have recently been infected by rabies or anthrax or other virulent organisms be regarded in the same light with the ordinary suppurating wound. Suppuration is not a necessary symptom of the first class; and the latter must have needs been impacted many hours before suppuration is observed.

It would seem that the ultimate use of antiseptics is to be confined largely to the destruction of bacteria outside of the animal body in order to prevent their admission therein. In the animal tissue bacteria are living cells lying against living animal cells of a very similar degree of vitality. Foreign agents which destroy one destroy the other; and it is very questionable whether an agent will ever be found capable of exercising a selective action upon the parasitic cells. In general therapeutics as well as in surgery there is a growing tendency to give the natural vital forces a chance to do what they can, —a growing faith in the *vis medicatrix naturæ.*

JAMES P. WARBASSE.

# REVIEWS OF BOOKS.

La Pratique des Operations nouvelles en Chirurgie. Par M. A. Guillemain. Paris: Baillière et Fils, 1895.

This little work calls for the most hearty commendations. It gives in brief and concise language an account of the chief recent operations in surgery. As the author says, it makes no pretence at being complete, and he owns that some difference of opinion may exist as to what measures should be included under "new operations."

The first chapter deals with the head, and gives an excellent account of the chief operations upon the brain and of the exposure of the mastoid antrum. We are surprised to note that the operative treatment of thrombosis of the lateral sinus is overlooked, and we miss Rose's operation for the removal of the Gasserian ganglion.

Chapter II deals with the trunk, and contains sections on pulmonary surgery, on partial thyroidectomy, and on the cure of spina bifida. Many of these sections can hardly claim to be "new." The third chapter is headed, "The Alimentary Canal." It contains a full account of Lucas-Championnière's operation for hernia, of Félizet's operation for hernia in children, of the operation of orchidopexy, of Senn's plates, and of Murphy's button, and an excellent description of the principal modern operations on the stomach. The whole of this chapter is of much value.

Chapter IV deals with the liver, the pelvis, the anus, and rectum. The sections which will be read with most interest are those dealing with operations on the bile-ducts, the operation of total hepatopexy by Gérard Marchand, transiliac drainage of the pelvis, and the treatment of prolapsus ani.

Chapters V and VI deal with the genito-urinary organs, and contain many admirable paragraphs, especially those on hysterectomy. The last chapter on general surgery contains such matters as bone-grafting, synovectomy, arthrodesis, the interscapulo-thoracic amputation, the much-talked-of operations of Hoffa and Lorenz for congenital dislocations of the hip, and Phelps's operation for club-foot.

A TEXT-BOOK OF OPERATIVE SURGERY. By THEODORE KOCHER. Translated by DR. HAROLD STILES. With 185 illustrations. London: Adam and Charles Black, 1895.

This is an English edition of the last issue of Kocher's well-known work on operative surgery. The translation has been well done, and the publishers have produced it in the form of a handsome, well-executed volume. It is well known that this work is the result of the author's own experience; that it deals with only such measures as he himself employs, and that it makes no attempt at being a systematic treatise on the operations of surgery. The value of the work, indeed, lies in its personal element, in the fact that it is the actual surgical creed of a well-known and experienced operator. He has found certain measures succeed, and he commends them and describes them.

The volume is nicely arranged, and the operations are arranged according to the various anatomical districts dealt with. The illustrations are numerous, original, and excellent.

The operations upon nerves are particularly well described and form a very valuable element in the work, especially as in many systematic text-books this department of surgery is feebly represented.

Those who are familiar with Kocher's work will turn with interest to the accounts of his operations on the thyroid gland, on the tongue, for the radical cure of hernia, for pyloric resection, and to his descriptions of resections of joints.

In many points it is needless to say that the writer will appear to some to be a little out of touch with what is called the surgery of the day, and even to be a little behind the times, but, as already stated, the work pretends to be no other than an account of the author's own methods, and as such it will be accepted with admiration and appreciation.

The chapter on amputations is, perhaps, the least satisfactory of the many most excellent sections in an excellent work.

CHIRURGIE DE L'URETÈRE. By DR. GLANTENAY. Paris: Baillière et Fils, 1895.

This volume is a useful *résumé* of the literature of a somewhat obscure surgical subject.

It commences with an elaborate account of the anatomy of the ureter, and, indeed, no less than fifty pages are devoted to this subject.

Then follows a chapter on the methods of exposing the ureter in actual surgical practice. A third chapter concerns itself with ureterotomy and ureterolithotomy, and another with resection of the ureter.

The work has been compiled with much labor and much thoroughness, and will be of especial value to all surgeons who are interested in this complex branch of surgical work.

It is of necessity largely concerned with renal surgery. No great novelty will be found in the author's pages, and his conclusions will be probably endorsed by all.

He has little that is encouraging to say on the operative treatment of stricture of the ureter, and, while he advises the removal of the ureter in cases of nephrectomy for suppurating kidney, he acknowledges the difficulty of the measure.

He points out how readily the ureter can be reached at almost any point by means of a post-peritoneal incision. This will be evident to all who have exposed a kidney from the loin, or who have approached the common iliac artery through the old iliac or extra-peritoneal incision.

THE SURGICAL DISEASES OF CHILDREN AND THEIR TREATMENT BY MODERN METHODS. By D'ARCY POWER, Surgeon to the Victoria Hospital for Children, London. London: Lewis, Gower Street, 1895.

This work does not quite bear out its somewhat ambitious title. The author does not in all sections of his book cling to modern methods, and, indeed, in certain departments of treatment he favors procedures that are ancient and in the opinion of many superseded.

The volume, however, presents a fair although imperfect summary of the literature of the surgical diseases of children. Some of the more efficient chapters are those on injuries of bones, on scurvy and rickets, on disease of the temporal bone, and on affections of the air-passages. The chapter on the abdomen lack completeness. In the matter of hernia, the author has closely followed the recent work of Félizet.

One is surprised to find that club-foot is not treated upon at all. The work will, no doubt, be much improved in its second edition.

THE MEDICAL ANNUAL FOR 1895. Bristol: John Wright & Co.

This work, which has been many times reviewed in these pages, maintains its position as a thoroughly sound and exhaustive review of the progress of medicine and surgery for the past year.

The compilation is exceedingly useful, and the names of the authors are a guarantee of the value of the work.

Among the articles calling for special notice, the following may be mentioned: Electro-Therapeutics, by Dr. Rockwell, of New York; Abdominal Surgery, by Mayo Robson; Angio-Neurosis, by Dr. Ramsay Smith; Ear Affections, by Dr. Dundas Grant; Fractures, by Arbuthnot Lane; Tuberculosis, by the same author.

The *Medical Annual* well deserves the sound position it has established, and the present volume is quite up to the standard of previous editions.

ON DISEASES OF THE VERMIFORM APPENDIX. By DR. HERBERT HAWKINS, Assistant Physician to St. Thomas's Hospital. London: Macmillan & Co., 1895.

This work—a graduation thesis—aims at collecting together the copious and scattered literature which deals with disease of the appendix and at arranging the facts with method and conciseness.

The result is a very interesting and valuable volume. The most serviceable parts of the book are those which deal with the cases admitted into St. Thomas's Hospital. The clinical aspects of perityphlitis are very fully dealt with. The differential diagnosis is practically left untouched. The author gives a full account, illustrated by good wood-cuts, of the morbid changes in the appendix, and demonstrates that perityphlitis may be set up by an appendix which presents no naked-eye evidence of change. To those interested in the pathology and clinical features of perityphlitis the work can be heartily commended. The treatment follows the lines usually observed among English physicians and surgeons.

F. TREVES.

I. CYSTITE ET INFECTION URINAIRE. Par le DR. MAX MELCHIOR. Traduit du Danois, Revue et Annotiée par le DR. NOEL HALLÉ.
II. CHIRURGIE DE L'URETHRE, DE LA VESSIE, DE LA PROSTATE. Par V. ROCHET.

Melchior's monograph is a valuable addition to the practical bacteriology of cystitis. It is based on a careful study, carried on within strictly scientific lines, of thirty-six cases of cystitis occurring in the Hôpital Fréderic in Copenhagen. The author took especial pains to assure the reliability of his work by adopting, after full experimentation, an elaborate system of disinfection of the urethra, thus avoiding the contamination of his strictly vesical bacteria with any of the numerous pathogenic urethral microbes. His aim has been, as Guyon observes in the preface, to recognize and identify existing species of organisms, not to discover and describe new ones. Accordingly, among the nine species he met with we find but two new ones, the *diplococcus ureæ liquefaciens*, and the *streptobacillus anthracoïdes*. It is to be noted that the ordinary pyogenic staphylococci are conspicuous by their absence, while in five cases pyogenic streptococci were found, apparently as the sole or chief causative agents.

Melchior, in the course of his argument, discusses other sources of infection than the direct or urethral source, and among the most interesting and valuable portions of his thesis are his investigations into the subject of descending infection, originating in the kidney, of infection through the blood, of the eliminating function of the kidneys during general infectious diseases, etc.

The whole essay is an admirable example of patient, scientific work, and is deserving of the eulogium it has received from Guyon. The notes of Hallé add to its practical value.

Melchior has appended a summary of his conclusions which are as follows:

(1) Every cystitis (with the exception of the rare instance in which it arises from chemical substances) is of microbic origin.

(2) Usually there is found in the urine of cystitis a pure culture of a single species, generally in enormous quantities.

(3) The bacillus found most frequently in cystitis, and described by different authors under different names, is identical with the ordinary intestinal parasite or bacterium coli commune; it is pyogenic and infectious, and of variable virulence.

(4) In the urethra pathogenic bacteria are frequently found which, when introduced into the bladder, may cause cystitis.

(5) A microbe alone does not produce cystitis. We are, however, familiar with one, the proteus of Hauser, which merely by its introduction into the bladder is able to determine a cystitis by virtue of its property of decomposing urea.

(6) A microbe can only cause a cystitis when the bladder has previously been rendered vulnerable to infection by different predisposing agents, especially retention or traumation.

(7) Retention of urine as well as traumatism are of themselves unable to provoke a cystitis. Microbic infection is always the determining cause.

(8) The different varieties of cystitis depend upon the pre-existing lesions, the character of the nutritive medium, and also upon differences in the virulence and other qualities of the bacteria.

(9) In every case of cystitis pus is found in the urine but in very different quantities; the existence of a catarrhal cystitis is doubtful. Even non-pyogenic microbes of the cellular tissue may provoke suppuration in the bladder.

(10) Ammoniacal urine may be a necessary condition for the establishment of a cystitis in a particular case, but it is often only an insignificant phenomenon which supervenes during the course of the disease or remains altogether absent.

(11) Aside from the bacillus tuberculosis, acid cystitis may be due to the bacterium coli commune, to the streptococcus pyogenes, and to other rarer micro-organisms (the gonococcus of Neisser, the typhoid bacillus, etc.). If urine in a case of cystitis is taken with aseptic precautions and gives no cultures when inoculated into

ordinary nutritive media, the case is in all probability one of tuberculosis.

(12) There are true blennorrhagic forms of cystitis caused by the gonococcus of Neisser.

(13) Urinary fever arises in part from the entrance of urinary microbes into the blood, and without doubt more frequently from an absorption of the dissolved bacterial toxines.

(14) In order to prevent a cystitis, it is not sufficient to render the urethral orifice perfectly aseptic; it is necessary also to use boric-acid irrigations of the urethra itself; without this one would begin by infection of the sterilized instrument.

(15) In the local treatment of cystitis the nitrate of silver is the sovereign remedy.

Professor Rochet's work is so incomplete, so poorly systematized, and so carelessly written that it is not likely to add to the reputation of its author. It may possibly serve a useful purpose as a foundation for some future editor, but Mr. Rochet has discarded so many operative procedures that are in favor, in England and America at least, and has described so many that are, as we think, justifiably in disrepute, that it seems of small value to either student or surgeon. His prefatory thanks to his "editeur" and his "dessinateur" must have been sarcastic. There is the usual absence in French publications of anything like a satisfactory index; while the drawings are nightmares.

J. W. WHITE.

TRANSACTIONS OF THE SOUTHERN SURGICAL AND GYNÆCOLOGICAL ASSOCIATION, Vol. VII. Seventh Session, held at Charleston, S. C., 1894. Published by the Association, 1895.

This volume contains a great deal of interesting and instructive material. Besides the numerous papers upon purely surgical subjects, there are a memorial address on Dr. Warren Stone, by Albert B. Mills, and "Reminiscences of J. Marion-Sims in Paris," by

Edmond Souchon, which are well written, interesting, and of much historic worth. Most of the papers are from the pens of Southern men, though the North has contributed through Price, Wyeth, Hall, Marcy, and Lydston.

The character of the work done by this society we may judge to be of a high order; and the scientific enthusiasm and good-fellowship among its members convince us that the first adjective in its name is intended only to be of geographical significance.

The Transactions are well gotten up.

J. P. WARBASSE.

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# OPERATIVE TREATMENT OF ANEURISMS OF THE THIRD PORTION OF THE SUBCLAVIAN ARTERY.[1]

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## History.

THE aim of this effort is to fix the present state of the science and art of surgery on the most important subject of the operative treatment of aneurisms of the third portion of the subclavian artery, and to endeavor to outline rules of treatment for the future.

Considering the relative frequency of the disease and the deadly results of so many bloody operations performed by famed and bold surgeons upon no less brave and courageous patients, there is no subject worthier of the deepest thoughts of the most surgically gifted, even of the envied ones blessed with the divine spark called genius.

As far as we could ascertain by our own researches and through circular postal cards sent to all the surgeons of note of America and of Europe, this is the first time that this subject is thoroughly studied in all its bearings as a distinct disease. It is based on the study of 115 operated cases herein reported, of which thirty-one are traumatic, eighty-one idiopathic, and three recurrent. Never before have the traumatic aneurisms of the third portion been described at all, although replete with most poignant interest. There exists no description of recurrent aneurism, nor of the peculiarities of those aneurisms on the left side, and some of these peculiarities are of prime importance.

Arterio-venous aneurisms are barely mentioned.

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[1] Read at the meeting of the Louisiana State Medical Society, at New Orleans, La., on May 7, 1895.

These are the first and most important clinical distinctions, but there are others, also clinical, to be mentioned below, quite as important to make at the very beginning, if we wish to understand each other and to prevent one from thinking of one form of the disease when a speaker or writer is thinking of another. This confusion is made all along in books and in discussions in societies, and is the cause of a great deal of useless talk and of a great waste of valuable time. All text-books speak of this subject, but more or less briefly and more or less confusedly.

We are especially indebted to the elegant and able pen of the accomplished late T. T. Sabine[1] for a masterly handling of a certain part of the subject; to the remarkable statistics of Alfred Poland,[2] of Koch,[3] of Crisp,[4] of Norris.[5] Also to the energetic and painstaking Wyeth,[6] of New York; to the achievements of the world-renowned Senn,[7] of Ballance and Edmunds,[8] and, finally, to the regretted Professor Leon Lefort,[9] of Paris, but recently deceased. We are under much obligation to the National Bureau of Medical Bibliography, of Washington, D. C.,[10] for valuable researches in the Library of the Surgeon-General's Office.

There are no less than ninety-five names connected with the evolution of the history of the operative treatment of aneurisms of this third portion, and such a galaxy of mighty brains!

## GENERAL CONSIDERATIONS.

*Frequency.*—Aneurisms of the subclavian artery are nearly as frequent as those of the carotid. They are more frequent on the third portion (Poland).

They are more frequent on the right side, 66 per cent., than on the left; out of 120 cases, 85 were on the right side; 2 cases included both sides (Poland).

The spontaneous or idiopathic are six times more common (Poland).

*Important Rule.*—A most important rule is that no operation should be attempted until all the non-operative measures have been tried.

Out of 22 cases, 4 cured spontaneously, 18 per cent.; 18 died, 81 per cent. (Poland).

Out of 14 cases treated by Valsalva's method more or less modified, 7 recovered, 50 per cent.; 2 were lost sight of during the process of cure, and 5 died, 35 per cent.[11]

Again, out of 5 cases treated by direct pressure without operative procedures, 4 were cured and 1 died, 20 per cent.[12]

Lastly, out of 6 cases treated by massage and kneading, 3 were cured, 50 per cent.; and 3 died, 50 per cent. (Wyeth).

Out of 35 cases where no operation was resorted to, 11 recovered, 31 per cent.; 23 died, 65 per cent.; and 1 was improved.[13]

The non-operative measures to be tried before operating are judicious venesection, prolonged, persistent, and perfect rest in decubitus, low diet, heart depressants carefully used, iodide of potassium in increasing doses, compression on the tumor, iced applications, kneading.[14]

Direct pressure may be practised by means of any substance that will press equally upon the outer surfaces of the tumor, applied gradually in order to accustom the patient and the tumor to its presence.[15]

Dr. Wyeth recommends a soft rubber ball placed upon the tumor and gradually brought to press upon it by means of a bandage around the neck and beneath the axilla.[16]

Traumatic aneurisms also may be cured by digital compression of the artery.

A case is reported by Bergmann of a man of thirty who received a punctured wound in the left subclavian artery; profuse hæmorrhage with extensive infiltration of blood in anterior and lateral walls of thorax; nine weeks later, after external wound had healed and infiltration had disappeared, patient presented under the left pectoral muscle a large pulsating tumor, which, through pressure on the brachial nerves, was causing much disturbance of sensibility; the aneurism was ultimately cured by digital compression above the clavicle.[17]

The following is another case reported by Warren-Stone:

Traumatic aneurism of left subclavian; distal pressure applied to third portion of the artery for thirty-nine hours; tumor diminished one-half in size; was much harder and its pulsations feebler; it continued to diminish, and in nine months all pulsations had disappeared; two years later the tumor reduced to a pulseless, barely recognizable stump.[18] The pressure on the sac itself would not be so likely to succeed in traumatic aneurisms.

The introduction of wire, horse-hair, galvano-puncture, and injections in the cavity of the sac are not to be practised.[19]

## Divisions and Subdivisions, or Clinical Forms and Varieties.

The first of the clinical distinctions is to treat separately of the aneurisms on the right side and of those on the left side.

*Aneurisms of the Third Portion of the Right Subclavian Artery.*—On the right side we must study the traumatic aneurisms and the idiopathic; then the recurrent, which may be traumatic or idiopathic. This division of aneurisms into traumatic and idiopathic commends itself here especially.

The greatest point of difference besides the cause is that in the former it is only a coincidence, when the arterial walls are diseased and the general condition of the patient not good; whereas in the latter a more or less advanced diseased state of the walls is constantly present and the general health of the subject is more or less impaired so as to bring about such a state of the arterial tissues. This sufficiently accounts for the marked discrepancies in the results of operations in the two kinds of aneurisms.

*Traumatic Aneurisms of the Right Side.*—We succeeded in collecting fourteen cases of traumatic aneurisms of the right side under the names of Colles, Bullen, Arendt, Wattman, Auvert, Roux, Pitha, Cuveiller, Langenbeck (three cases), Thiersch, Lewtas, and Miles.

We did not include any case due to so-called "strains," or catching at something or other in a fall, etc., but we have included those cases where an aneurism developed after a blow direct on the region where the tumor appeared, and also those following dislocations of the shoulder and due either to the injury or to the reduction by the surgeon.

I.—1811. Colles. Right traumatic aneurism; ligation of first portion. Man aged thirty-three years. Patient thinks he repeatedly hurt himself by endeavoring to push with his shoulder a loaded car, the wheels of which had sunk deep into the mud; about a week after this exertion he began to complain and felt a tumor the size of a cherry; on account of subclavian being diseased, the ligature was placed within one-half inch of innominate; pleura wounded; ligature not tightened immediately; on fourth day, hæmorrhage and death; ulceration of subclavian near ligature.[20]

II.—1823. Bullen. Right traumatic subclavio-axillary aneurism; tar-barrel fell on shoulder; ligature of second portion; hæmorrhage; cure. Right pulse, which was scarcely perceptible before ligature, was very distinct after.[21a]

III.—1827. Arendt. Man aged thirty-six years. Blow on shoulder, which swelled immediately, but subsided upon application of cold; six weeks before the operation tumor had reappeared and increased rapidly in size; ligature of innominate half an inch below the bifurcation; pyæmia (?); exhaustion; death on eighth day; innominate closed, ligature not being separated.[21b]

IV.—1843. Wattman. Right (or left) traumatic subclavian aneurism, due to shot-wound; ligature of third portion; hæmorrhage; death.[22]

V.—1848. Auvert. Right traumatic subclavian aneurism following reduction of dislocation of shoulder; ligature of first portion; hæmorrhage; death; proximal end closed by clot; distal end open.[23]

VI.—1855. Roux. Right traumatic aneurism from punctured wound of axilla and shoulder; ligation of second portion; on third, fourth, or fifth day, hæmorrhages; death.[24]

VII.—1856. Pitha. Right traumatic diffuse aneurism, due to rupture of circumflex artery in attempting to reduce a dislocation of the shoulder; tumor size of a man's head; ligature between the scalenes; pneumonia; death.[25]

VIII.—1859. Cuveiller. Large right traumatic aneurism of third portion of subclavian from bayonet-wound; ligation of the first portion of the subclavian and also of the common carotid; on fifth day, recurrent hæmorrhage; on ninth day, death from exhaustion; distal end of subclavian opened, but proximal end closed; the ligature had been applied close to the origin of the collateral branches; common carotid closed.[26]

IX.—1862. Langenbeck, No. 1. Right (?) traumatic diffuse aneurism due to stab-wound necessitating ligature of subclavian between the scalenes; pyæmia; death on ninth day; thrombus formed on either side of artery.[27]

X.—1882. Thiersch, of Leipsic. Right traumatic subclavian aneurism. Man, aged twenty-eight years; punctured wound of neck; profuse hæmorrhage, which stopped spontaneously next day; large tumor in supra- and infraclavicular regions presenting all symptoms of aneurism; return of hæmorrhage; ligature of subclavian in third portion; incision of sac and clots turned out; tried to ligate the ends of the vessel, but could not find them; pyæmia and, on the fifteenth day, death.[28]

XI.—1884. Langenbeck, No. 2. Right (?) traumatic aneurism, from bullet-wound injuring the subclavian artery and brachial plexus; there was the formation of a slowly increasing hæmatoma; repeated slight bleeding from it and subsequent anæmia, incision of the sac, turning out of the clots and ligation of both ends; cured.[29]

XII.—1884. Langenbeck, No. 3. Right (?) traumatic aneurism on a young lad who had a penetrating wound from a knife, causing considerable effusion of blood under the soft parts of the anterior wall of the thorax; pyæmia; death.[30]

XIII.—1889. Lewtas. Man, aged thirty years; explosion of shot-gun; piece of breech penetrated the neck above right clavicle; wound about one inch in length in front of attachment of sterno-mastoid muscle; hæmorrhage from wound for three days; swelling as large as a fœtal head at term in posterior triangle of neck; swelling is hard, but is not pulsating; wound enlarged, finger introduced, removal of a piece of steel weighing three drachms; alarming hæmorrhage upon withdrawal of the finger; reintroduction of the finger, and detection of a wound in the subclavian artery behind the scalenus anticus; attempted to seize the vessel with Spencer Wells forceps guided by the touch, but failed; ligature of the common carotid with catgut, leaving ends of ligature long, so that by drawing upon them one might be guided to the innominate; ligature of the innominate with catgut, just below its bifurcation; incision of sac and removal of clots; drainage-tube; recovery; left hospital on forty-third day carrying his right arm in a sling; no pulsation in radial artery; slight pulsation in brachial. The author remarks candidly that had he known at the time how unsuccessful previous operations of that sort had been, he does not think that he would have undertaken it.[31a]

XIV.—1893. Miles. Right traumatic aneurism, due to gun-shot wound of the middle of the third portion; there was much swelling in the supraclavicular region; a provisional loop ligature was placed on the first portion of the subclavian,—that is, a silk loop was passed around the artery, and while the fingers of one hand pulled on the loop to raise the artery the index-finger of the other hand pressed on the artery against the loop; the axillary was compressed by an assistant; the tumor in the supraclavicular region was incised and the clots turned out; the proximal end of the wounded artery was first ligated, then the distal end; the provisional ligature was then removed; the wound granulated and the patient recovered without any peculiar symptoms.[31b]

Peculiar case.—1890. Twyman. The following case of Twyman, of "pseudo-aneurism of the third portion," is most instructive as simulating an aneurism of the third portion itself and showing the difficulty of diagnosis in some cases.

Girl, aged eighteen years; fell from a horse against a stump; fracture of right clavicle at the junction of the outer and middle third; formation of an aneurism, supposed to be due to the penetration of the artery by a sharp point of bone; when first seen the swelling was about the size of half of a walnut, just over the artery; at the time of admission in the hospital the swelling extended from the sterno-clavicular articulation to the top of the inner fragment (three and a half inches), partly overlapping the inner fragment and extending also to a point one and a half inch from the top of the acromion; upward the highest point reached was at the back of the fourth cervical vertebra, at a point half-way between the spine and the trachea; inward the tumor reached sufficiently far to press on the carotid vessels; operation thirty-one days after the accident; the innominate was easily ligated, being pulled up about three-quarters of an inch by the tumor; the carotid was ligated an inch above the bifurcation; eighteen hours after operation, comatose condition and death; autopsy shows wound of first part of subclavian at about one-sixth of an inch external—*i.e.*, distal—to the origin of the thyroid axis and vertebral; phrenic nerve involved in the greatly condensed and thickened fibrous tissue forming the sac.

Thus the symptoms were mostly those of an aneurism of the third portion, especially remembering the site of the fracture and the site of the first appearance of the tumor. The excessive swelling is evidently the reason that induced the operator to ligate the innominate; and the common carotid was ligated also to provide against secondary hæmorrhage. But the case was one of aneurism of the first portion near the second portion. The treatment happened to be the proper one.

If a provisional loop ligature had been applied here, the operator would have been much perplexed, after incising and removing the clots, at finding the third portion unwounded. Out of twenty-two accepted cases of such ligation as was done by Twyman, cerebral symptoms have occurred in three. It is little doubtful that pressure on the phrenic nerve assisted materially the fatal accident.[32]

FOURTEEN TRAUMATIC ANEURISMS OF THE

| No. | Year. | Name of Surgeon. | Cause and Duration of Aneurism. | Operation. |
|---|---|---|---|---|
| I. | 1811 | Colles. | Contusion of supraclavicular region; subclavian aneurism. | Ligation of first portion. |
| II. | 1823 | Bullen. | Tar-barrel fell on shoulder; subclavio-axillary aneurism. | Ligation of second portion. |
| III. | 1827 | Arendt. | Blow on shoulder; subclavian aneurism. | Ligation of innominate. |
| IV. | 1843 | Wattman. | Shot-wound; subclavio-axillary aneurism. | Ligation of third portion. |
| V. | 1848 | Auvert. | Followed reduction of dislocation of shoulder; subclavian aneurism. | Ligation of first portion. |
| VI. | 1855 | Roux. | Punctured wound of axilla. | Ligation of second portion; amputation at shoulder. |
| VII. | 1856 | Pitha | Rupture of circumflex artery in reducing dislocation; high axillary aneurism. | Ligation of second portion. |
| VIII. | 1859 | Cuveiller. | Bayonet - wound; subclavian aneurism. | Ligation of first portion; also of common carotid. |
| IX. | 1862 | Langenbeck, No. 1. | Stab-wound; diffuse subclavio-axillary aneurism. | Ligation of second portion. |
| X. | 1882 | Thiersch. | Punctured wound, outer part; subclavio-axillary aneurism. | Ligation of third portion; incision of sac; tried to ligate both ends, but could not find them. |
| XI. | 1884 | Langenbeck, No. 2. | Bullet-wound (side not mentioned); subclavio-axillary aneurism. | Incision of tumor; ligation of both ends. |
| XII. | 1884 | Langenbeck, No. 3. | Knife-wound (side not mentioned); subclavio-axillary aneurism | Sawing through clavicle; ligation of both ends. |
| XIII | 1889 | Lewtas. | Shot-gun wound; subclavian aneurism, wound close to anterior scalene. | Ligation of innominate and of common carotid. |
| XIV. | 1893 | Miles. | Gunshot wound; subclavian aneurism. | Provisional loop ligature on first portion; incision of sac; ligation of both ends. |
| (?) | 1890 | Twyman. | Wound from fractured clavicle of first portion of subclavian; pseudo-supraclavicular aneurism. | Ligation of innominate and of carotid. |

Third Portion of the Right Subclavian Artery.

| Complications. | Result | Remarks. | References. |
|---|---|---|---|
| Hæmorrhage. | Death. | Pleura wounded. | Edinburgh Medical and Surgical Journal, Vol. XI; Norris's Contributions to Practical Surgery, Philadelphia, 1873; Arch. klin. Chir., Bd. X; Wyeth's Essays, p. 170. |
| Hæmorrhage. | Cure. | Day before, patient had coughed up contents of sac. | London Medical Repository, 1823, Vol. XX, p. 190; Wyeth's Essays, p. 178. |
| Pyæmia; exhaustion. | Death on 8th day. | . . . . . . . . . . . . . . . | Chelius's System of Surgery; Norris's Contributions; Guy's Hospital Reports; Wyeth's Essays, p. 164. |
| Hæmorrhage (?) | Death. | Side not positively stated. | Arch. klin Chir., Bd. X, p. 228; Wyeth's Essays, p. 188. |
| Hæmorrhage. | " | Proximal end closed by clot; distal end open. | Guy's Hospital Reports, XV; Wyeth's Essays, p. 172. |
| Hæmorrhage. | " | . . . . . . . . . . . . . . . | Quarante Années de Pratique Chirurgicale; Wyeth's Essays, p. 175. |
| Pneumonia. | " | Tumor size of a man's head. | Wyeth, op. cit., p. 175; Arch. klin. Chir., Bd. X. |
| Hæmorrhage. | " | Distal end of subclavian opened; proximal end closed; carotid closed. | Gazette des Hôpitaux de Paris, 1860, XXIII, 130; Guy's Hospital Reports, p. 130; Arch. klin. Chir., Bd. X; Wyeth's Essays, p. 174. |
| Pyæmia. | " | Thrombus on either side of artery. | Wyeth, op. cit., p. 176; Arch. klin. Chir., Bd. X. |
| Hæmorrhage and pyæmia. | " | . . . . . . . . . . . . . . . | Jaccoud's Dictionary, 1882, Article Artère Sous-Clâviére, Georges Poinsot, p. 419; Arch klin. Chir., Bd X, p. 236; also Wyeth's Essays. p 204. |
| Hæmorrhage repeated. | Cure. | There was formation of a slowly-developing hæmatoma; side not stated. | London Medical Record, August 15, 1884; American Journal Medical Sciences, 1884, Vol. LXXXVIII, p. 589. |
| Pyæmia. | Death. | Considerable effusion of blood in walls of thorax; side not stated. | London Medical Record, August 15, 1884; American Journal Medical Sciences, 1884, Vol. LXXXVIII, p. 589. |
| None. | Cure. | Incision of sac; removal of clots; no ligation of wounded end of artery. | British Medical Journal, August 10, 1889, p. 312. |
| None. | " | . . . . . . . . . . . . . . | Medical News, Philadelphia, August 19, 1893. |
| Cerebral complications. | Death. | Is a case of pseudo-supraclavicular aneurism; great swelling in supraclavicular space, simulating aneurism of the third portion. | London Lancet, 1890, Vol. I, p. 1352. |

### DEDUCTIONS. RIGHT TRAUMATIC ANEURISMS.

By studying these fourteen cases closely the following facts force themselves prominently upon a surgical mind:

Some cases were accompanied with little swelling and others with much; these were more difficult, of course.

Some of the cases were subclavio-axillary or high axillary aneurisms, but with much swelling in the supraclavicular region, making them practically aneurisms of the third portion as far as the treatment is concerned.

Out of fourteen operated cases of right traumatic aneurism, three recovered (Bullen, Lewtas, Miles).

The innominate was ligated alone in one case (Arendt), the patient succumbed to exhaustion, probably due to pyæmia.

The innominate and the common carotid were ligated simultaneously in two cases; Lewtas's case recovered. Twyman's patient died of cerebral complications.

The first portion of the subclavian alone was ligated in two cases (Colles No. 1, Auvert); both cases died of hæmorrhage.

The first portion and the common carotid were ligated simultaneously in one case (Cuveiller), the patient died also of hæmorrhage.

The second portion was ligated in three cases (Roux, Pitha, Langenbeck, No. 1); all died; one died of hæmorrhage (Roux), one of pneumonia (Pitha), and one of pyæmia (Langenbeck, No. 1). Dr. Wyeth says that in five cases where the subclavian was ligated in its second portion for aneurism and other causes, it has proved as invariably fatal as in the first portion.[33]

Our table does bear out the statement of Wyeth that the ligature of the second portion on the right side is as unsafe as that of the first portion. So that every effort should be made to avoid the application of the ligature there; but when the necessity still exists, the scalene should be completely divided and all the neighboring branches tied on either side of two ligatures between which the main trunk should be divided and each end twisted securely, when it is not involved in the disease to such an extent as to contra-indicate torsion.[34]

The close proximity of the first and second portions of the right subclavian to the heart, and their position causing them to receive the full and direct force of the heart's action, is said to be the cause of the failure of the ligation of the first and second portions.

Dr. Wyeth is entitled to much credit for the perspicacity displayed in establishing this fact, which will be the saving of many lives.

The third portion was ligated in three cases (Colles, No. 2, Bullen, and Thiersch); one died (Colles) of pyæmia and gangrene.

The third portion was ligated previous to incising the sac in one case (Thiersch), and an anxious search was made for the two ends of the wounded artery to tie them, but they could not be found. The patient had a terrific secondary hæmorrhage, but he finally recovered.

The sac was incised without any previous ligation of any kind and the two ends ligated in one case (Langenbeck No. 2); there was hæmorrhage, of which the patient recovered, but he finally died of pyæmia.

In one case (Langenbeck, No. 3) the clavicle was sawn through and the two ends ligated; the patient died of pyæmia.

In one case a provisional ligature was applied by our lamented Miles, for the first and only time, on the first portion of the subclavian; the sac was incised and the two ends ligated; the patient recovered.

In several cases only one ligature was applied and no attempt was made to incise the sac, turn out the clots, and ligate the two ends.

Although two cases (Bullen and Lewtas) recovered after simply ligating the artery, such cases being still more numerous on the left side, yet the incision of the sac, and especially the ligation of the two ends, is in thorough accord with the Anglo-Saxon ideas of treating traumatic aneurisms.

It insures against any possible distal hæmorrhage and prevents all recurrent aneurisms.

However, the advantages of the Miles provisional ligature are gained at the expense of two regular operations, both somewhat risky; the incision of the sac which is exposed to suppuration and sepsis, and the ligation of the first portion of the subclavian; risky also in the possibility of accidentally wounding the pleura, the nerves, or the right lymphatic duct, and in creating a second focus of possible suppuration and sepsis.

Some may justly say that Miles's provisional ligature was an unnecessary operation, since in several cases, especially on the left side, the third portion was ligated, although so much swelling existed that the wound was three inches deep and was very narrow and dark. But this was one of those very rare "fortunate mistakes," because it brought out a new procedure which, although misapplied in the Miles case, yet called the attention of the profession to a procedure which constitutes a real progress in curing some cases which otherwise would be surely lost.

Thus in many cases, by applying a provisional ligature on the second portion, the wounded third portion could have been ligated safely, and thus many lives saved.

Similar provisional ligatures had before this one been applied to the other large arteries of the region.

In 1884, Walter Rivington placed a provisional ligature on the common carotid, while the bleeding-point was being searched for. It was in a case of wound of the parotid gland; no hæmorrhage at the time of entrance in hospital; suture; on eighth day secondary hæmorrhage stopped by pressure; erysipelas; abscess; incision; return of hæmorrhage; catgut provisional ligature of common carotid; ligation of bleeding vessel; recovery.[35]

In 1888, at a meeting of the Medical Society of London, Frederic Treves described a plan of exposing the carotid and passing a thread of catgut around it; if the loop thus formed was pulled up, pulsation in the artery stopped; if it were released, circulation went on again; by this means circulation could be controlled while the bleeding smaller branches were searched for and ligated. He referred to four instances in which this manœuvre had been carried out successfully.

One great recommendation of the method was that there were no great risks from the operation itself, and there was no local inflammation in any of the four cases. Mr. Treves says also that no obstruction of the vessel had followed in the cases he had related.[36]

A somewhat analogous case is on record in that region, the one of Dr. Peixoto, of Portugal. In 1851 he placed a moderately tight precautionary or expectant ligature around the innominate on account of secondary hæmorrhage from the common carotid, which had been ligated three weeks previously.[37]

However, we should also bear in mind that after incising the sac and turning out the clots, it is possible that the two ends may not be found, as it happened to the celebrated Thiersch, hence hæmorrhage and all its possible consequences.

It is preferable therefore to ligate the third portion, if possible, and await developments before opening the sac and ligating the two ends.

The complications were in a general way: operative hæmorrhage in eight, pyæmia in four, pneumonia in one, cerebral symptoms in one (Twyman).

Lewtas's and Miles's cases were the only two that presented no complications.

The relative frequency and gravity of each complication can only be studied profitably and with justice in connection with the ligation of each portion of the artery.

We must not lose sight of the fact that almost all these operations belong to the pre-aseptic period, and there is no evidence that those performed since that era have been done as thoroughly antiseptically as is required, and with double absorbable ligatures without rupturing the coats. Hæmorrhage and pyæmia have no *raison d'être* to-day.

There are therefore three clinical forms of traumatic aneurisms.

(1) Traumatic aneurisms where the swelling, moderate or great, of the supraclavicular space does not prevent the reaching of the artery through this region.

(2) Traumatic aneurisms where the swelling of the region is such that it is impossible to reach the artery in that locality.

(3) Traumatic aneurisms where the artery is found wounded near the outer edge of the scalene.

*Traumatic Aneurisms with Moderate Swelling.*—In cases of traumatic aneurisms with moderate swelling it is the writer's belief that a *provisional* ligature can be applied as safely on the *second portion* as has been done on the first portion, and that this should be done in preference.

By perusing the record of the cases of the right and of the left aneurisms, it will be seen that in some cases the artery was reached at the depth of even three inches.

The scalene should be divided in part or in totality if necessary, taking care to avoid the phrenic nerve.

Therefore, in all cases of traumatic aneurism of the third portion, even in cases with marked swelling in the supraclavicular region, an attempt should be made to reach the third portion near the scalene, or, if necessary, the second portion between the scalenes, and pass around it a provisional loop ligature,—that is, a strong, thick silk thread, using an aneurism-needle with a movable point, if necessary; then, without attempting to make any knot, but simply by pulling firmly on the two ends of the thread, so as to raise the artery, arrest the circulation through it. If needs be, the index-finger of the other hand can press the artery against the thread.

The effect of this procedure should stop the pulsation in the tumor and in the axillary artery; however, the latter should be compressed in the axilla to secure against collateral circulation.

Then the sac should be incised and the clots turned out in order to reach the two ends and secure them, then the provisional ligature is removed.

In this way there is only one wound, and there is less risk of injuring the important structures which surround the first portion.

*Traumatic Aneurisms with Excessive Swelling.*—It is only in cases where this attempt has failed from excessive swelling of the region that the surgeon would be justified in placing the provisional ligature on the first portion with all the attending risks enumerated above.

*Traumatic Aneurisms in which the Third Portion is Wounded near the Border of the Scalene.*—In those cases where, after applying the provisional ligature and before or after incising the sac, the artery is found wounded near the outer edge of the scalene, too close to hold a ligature,—*i.e.*, less than half an inch,—the second portion of the artery should be ligated with a double or triple non-contiguous catgut ligature, without rupturing the coats of the vessel, after the manner recommended first by Senn.

*Idiopathic or Spontaneous Aneurisms of the Third Portion of the Right Subclavian Artery.*—A very large number of operations have been proposed and performed for idiopathic or spontaneous aneurisms, but with lamentable results, the very few cases which have recovered have done so almost accidentally as it were, there being so many failures to one recovery by the same procedure or by similar ones.[38]

They have been treated by needling, by the opening of the sac, by the ligation of the arteries of the region, by the extirpation of the sac, by amputation at the shoulder-joint.

*Needling* (after Macewen's Process).—Needling, after Dr. Macewen's process is highly recommended by Dr. C. Nancrede.[39]

It consists of driving long, slender needles into the sac with a view of irritating the surface, thereby causing the formation of adherent fibrinous clots. It is contra-indicated when the walls are thin.

The discussion which followed the reading of this paper, before the American Surgical Association, did not elicit much confidence in this mode of treatment over the others.

However, Dr. J. D. Bryant, of New York, says that the lease of life gained by the fine needle insertion method of Macewen (and galvano-puncture, its associated treatment) warrants a strong belief in the benefit of these expedients when employed singly or with ligature.[40]

*Old Method.—Opening of the Sac and Ligature above and below.*—There are two cases recorded of the operation by the old method of opening the sac and ligating above and below.

The first case is the one of Syme. It is a case in which was practised digital compression of the subclavian artery on the first rib through an incision made in the tissues covering it, previous to opening the sac.

It is not properly a case of pure subclavian aneurism but of the axillary at its junction with the subclavian, a subclavio-axillary, but it extends high up above the clavicle. Besides, Syme tried there a practice which others might be tempted to follow but for the timely warning of this present account.

This case is that of a man aged forty-seven years; violent jerk of the shoulder but no wound of the artery; large tumor in axilla extending above the shoulder; distinct aneurismal bruit, but no pulsation; rapid increase of tumor; it so extended above the clavicle that ligation of the subclavian was judged impossible; incision along the outer edge of sterno-mastoid through the platysma and fascia so as to allow a finger to be pushed down to the situation where the subclavian artery issues from under the scalenus anticus and lies upon the first rib; tumor then incised; violent gush of blood showed that the artery was not effectually compressed; plugging of the wound with hand; an assistant by a slight movement of his finger, which had been thrust deeply under the upper edge of the tumor through the clot, succeeded in getting command of the vessel; cavity of sac laid open; seven and a half pounds of coagulated blood removed; artery seemed to be torn across; free bleeding from lower end of artery which is secured; section of pectoral muscles close up to the clavicle and, holding the upper end of the vessel between finger and thumb, the operator passed an aneurism needle so as to apply a ligature about half an inch above the orifice; the elevation of the clavicle, which rendered the artery so inaccessible from above, facilitated this procedure from below; sutures; suppuration; six weeks after operation the patient was discharged; he is now in perfect health.

The skilful assistant of the great Syme on this eventful occasion was no less than the future immortal Lister himself.[41]

The second case was that of Dr. Smyth.

Upon the recurrence of the aneurism in his famous case, Dr. Smyth incised the sac with the hope of plugging the orifice of the artery, but the hæmorrhage was so fearful he had to desist and plug the sac with lint and apply a bandage; the man barely escaped death on the table; he died from the effects of the hæmorrhage after forty-eight hours.[42]

*Ligations.*—The history of the treatment by ligature may be told in very few words, since they almost all died; but it is of the utmost importance to study the manner in which the failures occurred.

It must be well understood all along that in the following descriptions of ligations we will only consider those that were performed for aneurisms of the third portion of the right subclavian. However, cases where the second and first portions were involved with the third will be considered.

## Ligations of the Subclavian.

(1) *Ligation of the Third Portion alone of the Subclavian as a Proximal Operation.*—The third portion of the subclavian has been tied alone outside of the scalene muscles for aneurisms of the right subclavian low down, eleven times, with ten fatalities.

It is only possible when the tumor is small. It was done by Colles, Travers, Brodie, Green, Gore, Blaker, Stanley, Gregg, Drayton, Paget, Auvert.

I.—1813 or 1815. Colles. Man, aged forty-eight years; fall from a horse; subclavio-axillary aneurism; delirium and rapid gangrene of the limb; no clots on either side.[43]

II.—1823. Travers. Man, aged seventy-three years; subclavio-axillary aneurism; in passing needle the sac was penetrated; hæmorrhage; exhaustion; death.[44]

III.—1831. Brodie. Man, aged fifty years; subclavio-axillary aneurism; suppuration; death; coagula on both sides of ligature.[45]

IV.—Green. Man, aged thirty-five years; tumor small, on outer part of artery; ligature close to scalene; nerve of brachial plexus was included in the ligature; intense pain; removal of ligature; reapplication of ligature; never presented a bad symptom; cured; was seen several years after the operation and was quite well.[46]

V.—1851. Gore. Death.[47] No details obtainable.

VI.—1855. Blaker. Man, aged fifty-nine years; subclavio-axillary aneurism; hæmorrhage; death; proximal side open; distal side full of purulent matter.[48]

VII.—1856. Stanley. Man, aged forty years; subclavio-axillary aneurism; pleuritis; death; purulent infiltration of tissues around wound.[49]

VIII.—Gregg. Man, aged forty years; pyæmia and hæmorrhage; death; cardiac end closed; distal end open.[50]

IX.—1859. H. E. Drayton. Man, aged thirty-seven years; subclavio-axillary aneurism; due to a fall; phlebitis; coma; no hæmorrhage; death; artery closed on both sides of ligatured point.[51]

X.—1860. Paget. Man, aged fifty-four years; subclavio-axillary aneurism; hæmorrhage; death; sac suppurated; distal end closed; cardiac end closed; hæmorrhage, probably from branches connecting with sac.[52]

XI.—1858. Auvert. Man, aged thirty-six years; subclavio-axillary aneurism; pneumonia; hæmorrhage; death; rupture of artery at site of ligature.[53]

(2) *Ligation of the Second Portion of the Subclavian alone,—i.e., between the Scalenes.*—There are only two cases, by Liston and Gay, of ligation of the second portion of the right subclavian alone between the scalenes for spontaneous aneurism of the third portion.

The *first case* is the one of Liston. A subclavio-axillary aneurism, caused by a fall on the ice with the arm outstretched; the aneurism extended to near the scalenes; enormous swelling; nine months' duration; the artery was first tied in the third portion, but, being involved in the disease, a ligature was placed behind (between) the scalenes, on the second portion; hæmorrhage; death on fourteenth day; the vessel had given way near the external of the two ligatures, the innermost one having become loosened; both proximal and distal ends of the subclavian were opened.[54]

The *second case* is that of Gay. A subclavio-axillary aneurism; ligature between the scalenes; there was no pulsation in the subclavian when reached in the operation; death on the nineteenth day of bronchitis; thrombi on both sides of the ligature; death believed to be due to the bronchitis and not in any way connected with the operation or its results; "so far, the operation might be claimed to have been successful."[55]

We must remember that Wyeth says that the ligation of the second portion on the right side was fatal in five cases where it was applied, for whatever cause. Some cases were for traumatic aneurisms and some for other causes. It should be avoided, he says, but, if this is impossible, then the scalene should be completely divided and all the neighboring branches tied on either side of the two ligatures, between which the main trunk should be divided and each end twisted securely.[56]

However, by using a double or triple non-contiguous ligature, without rupturing the coats of the vessel, the operation may succeed. It is less dangerous than ligating the first portion.

(3) *Ligation of the First Portion alone of the Right Subclavian.*—The ligature of the first portion of the right subclavian

alone for spontaneous aneurism of the third portion has been done eight times, by Arendt, Bayer, Liston, Mott, Hayden, O'Reilly, Partridge, and Auvert.

I.—1826. Arendt. No details obtainable ; death on fourth day.[57]

II.—1829. Bayer. Man, aged twenty-one years ; subclavio-axillary aneurism ; hæmorrhage ; rupture of sac ; death.[58]

III.—1830. Liston. Man, aged thirty-two years ; subclavio-axillary aneurism ; hæmorrhage ; death ; central end subclavian closed by clot ; distal end open.[59]

IV.—1831. Valentine Mott. Female, aged twenty-one years ; hæmorrhage ; death.[60]

V.—1832. G. T. Hayden. Female, aged fifty-seven years ; hæmorrhage ; death ; artery ruptured at point of ligation.[61]

VI.—1833. O'Reilly. Male, aged thirty-nine years ; hæmorrhage ; death.[62]

VII.—1841. Partridge. Male, aged thirty-eight years ; pyæmia ; death fourth day ; no clot on either side of artery.[63]

VIII.—18—. Auvert. Man, aged thirty-six years ; subclavio-axillary aneurism ; hæmorrhage ; pneumonia ; death ; proximal end closed ; distal end open.[64]

(4) *Simultaneous Ligation of First Portion of the Right Subclavian and of the Common Carotid.*—There is only one case on record of simultaneous ligature of the first portion of the right subclavian artery and of the common carotid for spontaneous aneurism of the third portion.

It is the case of Liston (1838). Man, aged thirty-one years ; aneurism said to be traumatic, but not truly so, of six months' standing ; fainting, collapse, cerebral symptoms, dyspnœa, hæmorrhage, death ; pus in the mediastinum ; pericarditis ; innominate closed firmly ; carotid closed, subclavian open, as also vertebral and other intermediate branches ; the hæmorrhage had come from the distal end of the subclavian.[65]

Care was taken to ligate the first portion of the subclavian close to the innominate to have sufficient space between the ligature and the origin of the collateral branches for a clot to form ; this space is from one and a quarter to one and a half inches.

To insure a clot in the innominate, it was necessary to ligate the common carotid.[66]

The common carotid is ligated simultaneously to prevent distal secondary hæmorrhage. This was not likely to happen, since the distance between the bifurcation and the point of ligation was quite considerable, but it had happened with the subclavian when the distance between the ligature and the origin of the first large collateral branch was reasonable.

The ligature of the common carotid simultaneously with the subclavian was also to allow occlusion of the proximal end of the subclavian, which would not take place if the current swept freely from the innominate into the common carotid.[67]

(5) *Simultaneous Ligation of First Portion of the Right Subclavian, Common Carotid, and Vertebral.*—To guard against hæmorrhage through the distal end of the subclavian, the ligation also of the vertebral was advised by Kearney Rodgers (who had operated on the left side).

There is only one case of simultaneous ligation of the first portion of the right subclavian, common carotid, and vertebral, and that is the case of Willard Parker, of New York.

The aneurism was above the centre of the right clavicle. The patient died of distal hæmorrhage from the subclavian on the second day; the proximal end of the vertebral had ulcerated through.

The operation was performed at the New York Hospital on September 3, 1863.[68a]

Gross says it was on the left side, but the autopsy was made by Sands,[68b] and he mentions the right side every time. Besides, Wyeth says he obtained his notes from Parker himself.

Ligation of the first portion of the subclavian has been done ten times alone, or simultaneously with other arteries, for idiopathic subclavian aneurism of the third portion, and all resulted fatally. Arendt, Bayer, Liston (1830), Mott, Hayden, O'Reilly, Partridge, Auvert, Liston (1838), Willard Parker.

They all died of distal hæmorrhage from the subclavian except one case (Partridge) which died of pericarditis, pleuritis, and pyæmia; and one (Arendt) who died of exhaustion.

After all these disastrous results, the subclavian is abandoned as decidedly refractory to the operation, and the efforts are henceforth directed on the innominate.

(6) *Ligation of the Innominate Alone.*—The ligature of the innominate alone is as easy as that of the subclavian; it is less dangerous, not being so closely in relation with the pleura, the nerves, and the right lymphatic duct.[69]

There exist fourteen cases of ligature of the innominate alone for subclavian aneurism of the third portion. We include in this number cases called simply subclavian aneurisms, when the portion affected is not mentioned specially.

Those cases belong to Mott, Graefe, Norman, Dupuytren (the unknown), Hall, Bland, Lizars, Gore, Pirogoff, Porter, Bickersteth, O'Grady, Thompson, May.

I.—1818. Valentine Mott, New York. Man, aged fifty-seven years. Fall on shoulder; first portion diseased; ligation of innominate one-half inch below the bifurcation; tumor reduced one-third in size; left carotid became very much dilated; suppuration; hæmorrhage from wound; death; innominate not closed on proximal side; on distal side, ulceration of innominate, carotid, and subclavian; subclavian pervious throughout; carotid not quite occluded.[70]

II.—1822. Graefe, Berlin. Man, aged (?) years. First portion of subclavian involved; ligation of innominate one inch from aorta; hæmorrhage; death on sixty-seventh day; proximal end closed perfectly; distal end open.[71]

III.—1824. Norman, Bath. Man, aged (?) years. Hæmorrhage; death; no details obtainable.[72a]

IV.—183–.(?) Unknown. Reported by Dupuytren. Man, aged (?) years. Hæmorrhage; death on third day; no details obtainable.[72b]

V.—1830. Hall, Baltimore. Man, aged fifty-two years. Innominate diseased and dilated; after ligation, hæmorrhage from wound; death; pericarditis; aneurism-needle had partially transfixed artery accounting for hæmorrhage.[73]

VI.—1832. Bland, Sidney. Man, aged thirty-one years. Repeated hæmorrhages; death; proximal end closed; carotid closed completely; subclavian open.[74]

VII.—1837. Lizars, Edinburgh. Man, aged thirty years. Fall on right arm; suppuration; ligature loose on seventeenth day;

hæmorrhages from wound; death; hæmorrhage into the pleura; central end of innominate not entirely closed; subclavian pervious; hæmorrhage supposed to have come from subclavian and vertebral.[75]

VIII.—1856. Gore, Bath. Man, aged fifty-two years. Erysipelas; terrible hæmorrhage and death; cardiac end only partially closed; both subclavians closed; carotid of right side open.[76]

IX.—1856. Pirogoff, St. Petersburg. Man, aged forty-six years. Paralysis of left side of the face; death in forty-eight hours; pleuritis and pneumonia.[77a]

X.—1867. G. H. Porter, Dublin. Man, aged (?) years. Clamp applied for three days to innominate and then removed; pleuritis, pneumonia; death.[77b]

XI.—1868. E. B. Bickersteth, Liverpool. Man, aged forty years. First used a lead wire, replaced on second day by two silk ligatures; hæmorrhages; lead shots poured into wound; death; clot firm in innominate on cardiac side; subclavian occluded; carotid open.[78a]

XII.—1873. O'Grady, Dublin. Great shock; death after twenty hours.[78b]

XIII.—1882. Thompson, Dublin. Man, aged (?) years. Hæmorrhage; death.[79a]

XIV.—1886. Bennett, Birmingham. Man, aged thirty years. Large aneurism above the inner half of the clavicle. The common carotid artery is carried inward towards the middle line of the neck; pulsations very strong; all the superficial arteries are slightly fibroid; no evidence of disease of the heart or of the large blood-vessels; ligature of the innominate artery; it was rather superficial; it seemed to be unusually large, nearly an inch in diameter; compression made against the sternum by a finger behind the vessel controlled the pulsations both in the tumor and the carotid; structures over bifurcation and first portion of the subclavian much matted and could hardly be identified; also adhesion of innominate to sternum, hence difficulty of passing needle around; ox-aorta ligature; considerable force required in tightening, to stop the pulsations; breaking of the ligature; second ligature of same nature; also broke; made a ligature of six medium-sized threads of catgut; ligature tightened so as not to rupture the coats; operation under spray and careful Listerian antiseptic details; two weeks after, hæmorrhage, death; aneurism involved third portion partly, second portion mainly, first portion partly; no pus; ulceration along both sides of the ligature of the size of small pea.[79b]

(Dr. H. L. Burrell, of Boston, has reported a case of successful ligation of the innominate at the meeting of the American Surgical Association in New York, May 28, 1875. But it was for an aneurism at the root of the subclavian and common carotid.)

(7) *Simultaneous Ligation of the Innominate and Common Carotid.*—There are two cases by Mott and Coppinger where the innominate and the common carotid have been ligated simultaneously.

The *first case* is that of A. B. Mott, 1868. Man, aged (?) years; hæmorrhage in thorax: sac ruptured in pleural cavity.[80]

The *second case* is that of Dr. Charles Coppinger, surgeon to the Mater Misericordiæ Hospital of Dublin. Success depended upon keeping the wound aseptic. Man, aged fifty-three years. Came under treatment December 5, 1892; aneurisms of third and second portions of subclavian; size of a hen's egg; tense and elastic; vibrating thrill; apparently about to burst; also in the axilla tumor size of a walnut; also under clavicle a pulsating swelling; operation on January 9, 1893; common carotid ligated in two places and divided between; ligature of innominate; silk ligatures used; mindful of Dr. Banks's case, the operator abandoned the hope of being able to effectually tie kangaroo tendon in such a difficult situation, and therefore worked with silk; strict antisepsis; operation lasted thirty minutes.[81]

Six weeks after the operation the aneurism was still very perceptible as a large soft tumor in the patient's neck; it was entirely without pulsation, while, moreover, no pulse could be felt in either his right wrist or arm.[82]

The case was exhibited in the Section of Surgery of the Royal Academy of Medicine of Ireland.

At the time of the presentation, Mr. W. Thompson joined in the congratulations and said he took a special interest in the case, as he had gone through all the torture of failure when he thought he had obtained success. In the book he wrote on ligation of the innominate, he said very emphatically that if another such case came before him he would not hesitate to operate, because he believed the operation was one which must be successful.

He said he lost his case by the prolonged use of the drainage-tube, whereas in Coppinger's case there was an opportunity given for the rapid adhesion of all parts of the wound, and to this he attributed the success which had followed. In his own case there had been no suppuration in the wound, and it remained open for a considerable time.[83]

On July 4, 1895,—*i.e.*, over two years after the operation,—the patient had been in St. Bartholomew's Hospital, because his nervous system seemed somewhat broken down, but he was quite free from any sign of his old aneurism.[84a]

This case is now truly the culminating point in the history of the treatment of this disease by proximal ligation. Thus Coppinger stands the champion of proximal ligations.

However, the aneurism may yet return, as was exemplified in Smyth's case, soon to be mentioned.

(8) *Simultaneous Ligation of the Innominate, Common Carotid, and Vertebral.*—There are two cases of simultaneous ligature of the innominate, common carotid, and vertebral for subclavian aneurism of the third portion.

They are the cases of Bull and of Durante.

The case of Bull is most briefly reported wherever it is found; a double ligature of catgut was employed; hæmorrhage followed, and death supervened on the thirty-third day.[84b]

The case of Professor F. Durante, of Rome, Italy, was reported at the fourth meeting of the Italian Society of Surgery, April 4 to 7, 1887.[85]

Man, aged forty-five years. No apparent cause; tumor size of a large lemon protruding in the supraclavicular fossa; clavicle partly corroded; ligature of innominate, common carotid, and vertebral; on tenth day blood flows from the drainage-tube; it is checked by moderate but prolonged digital pressure; on same day hemiplegia of *right* side, which disappears in half a day, leaving paralysis of the face and tongue; death; near the ligatures the arterial walls appear almost completely dried, without phlogistic reaction; small coagulum near common carotid above ligature; aneurismal sac contains coagula of various consistence; brain presents embolic softening of left caudate nucleus; the embolism proceeded from the central portion of the thrombus, which, having undergone fatty degeneration, presented but few traces of organization.

Henderson says that the innominate was tied in two places, —viz., immediately below the junction of the subclavian and common carotid, and again slightly lower down. The vertebral was tied also. Henderson does not speak of the carotid, but Durante, in his private communications, states positively that the common carotid was also tied.[86]

Twyman says that apoplectic symptoms have been noted as occurring more than once in this operation. Out of twenty-two accepted cases collected from Erichsen's "Surgery" and Spencer's list, and including Lewtas's case and his own, cerebral symptoms have occurred in three.[87]

(9) *Simultaneous Ligation of the Innominate and Common Carotid, and, later, of the Vertebral.*—There is only one case on record of the simultaneous ligature of the innominate and common carotid, followed *fifty-four days later* by the ligation of the vertebral artery, for an aneurism of the third portion of the subclavian. It is the case of Dr. Andrew W. Smyth, of New Orleans, La.

(Chronologically this case should precede the others, but in a methodical description its proper place is here.)

A mulatto, aged thirty-four years. Right aneurism of the third portion, due to efforts made by the patient in catching at an anchor in trying to save himself from drowning in a collision at sea.

The innominate and common carotid were ligated on May 15, 1864; secondary hæmorrhage; ligature of the vertebral on July 9, 1864; the patient left the hospital apparently cured; ten years later he came back with the tumor as large as before; the internal mammary was ligated without any benefit; the sac, threatening to burst, was opened, with the hope of plugging the opening of the aneurismal artery, but in vain; plugging *en masse;* patient died of hæmorrhage within forty-eight hours; at autopsy (made by the writer), the recurrent collateral circulation took place through the anastomoses of the perforating branches of the aortic intercostals with the branches of the subscapular.[88]

The specimen is now preserved in the Army Medical Museum at Washington. (See Appendix.)

Smyth says he conceived the idea of ligating the vertebral from reading in Erichsen the enumeration of the anastomotic branches which carried on the collateral circulation.[89a]

For many long years this startling achievement stood in grand loneliness and splendor, a radiant beacon-light on these dark seas.

(10) *Simultaneous Ligation of the Innominate and Common Carotid, and Sixty-seven Days later, of First Portion of Subclavian.*—There is only one case on record of the simultaneous ligature of the innominate and common carotid, necessitating sixty-seven days later the ligature of the third portion of the subclavian. It is the celebrated case of Mitchell Banks, of Liverpool, in 1885.

Man, aged fifty years. Well-marked symptoms of aneurism of third portion of right subclavian; ligature of innominate and of common carotid with kangaroo tendon; pulsation became practically imperceptible; same evening, slight return of pulsation; by third day the pulsation is strong. Sixty-seven days later, ligation of first portion of subclavian; operation difficult and dangerous because of matted condition of tissues owing to first operation; on the twenty-third day after the last operation, hæmorrhage; death thirty-seven days after.[89b]

(11) *Ligation of the Third Portion of the Subclavian as a Distal Operation for Aneurism of the Third Portion of the Right Subclavian.*—Having been repulsed so often on the proximal side, the desperate surgeons attacked the disease on the distal side.

There is only one case of distal ligation of the third portion, with the aneurism between the ligature and the heart, *for an aneurism of the third portion.*

It is the case of Dr. Charles Monod, of Paris, France, upon which Professor Paul Berger read a masterly report to the Academy of Medicine of Paris. The common carotid was ligated simultaneously.

Man, aged fifty-one years. Tumor size of a small hen's egg; it is limited below and outward by the clavicle; it is lost towards the base of the neck in the deep region, without enabling to determine whether or not it was prolonged to the scalene.

The two radial pulses are alike; the compression of the axillary artery is without effect on the tumor, whereas the compression of the carotid at the neck diminishes very notably the intensity of the pulsations of the tumor. Professor Berger thinks that this was due to the extension of the aneurism to the second and first portions of the subclavian. Attempted to ligate the innominate, but it is found very deeply seated, dilated, and thinned, so the idea was abandoned. Ligation of the outer part of the third portion of the subclavian between the tumor and the clavicle; the space was very limited. Also ligation of the common carotid in order to prevent recurrent circulation and also because compression on this artery affected the intensity of the pulsations of the aneurism.

Four months after the operation all vestiges of the tumor have disappeared; the radial and the brachial pulse on the same side are still absent.[90]

In a personal communication, dated June 8, 1895, Dr. Monod states that his patient is still enjoying good health; he has no pain, but the radial pulse is still absent; there is a slight atrophy and stiffness of the forearm, wrist, and hand; these, however, are gradually improving.

(12) *Ligation of the Axillary alone as a Distal Operation on the Right Side.*—The ligature of the axillary artery alone as a distal operation on the right side has been employed five times, and in each instance certainly did no good, but probably hastened the fatal termination. Too many vessels are given off by the diseased part of the artery.[91]

Agnew states that it has been done by Dupuytren, Shuck, Canton, Pétrequin, and all died.[92a]

18—.—Dupuytren. Man, aged forty years. Tumor size of a hen's egg; artery ligated below clavicle; hæmorrhage from wound; syncope and death on the eighth day; no clot in artery at point of ligature; small opening in artery; subclavian diseased throughout.[92b]

1863.—Canton. Man, aged thirty-two years. Compression of axillary arrested pulsations in sac; artery tied at the edge of the coraco-brachial, tumor ceased immediately to pulsate; death eighteen days later; no cause stated.[92c]

18—.—Pétrequin. This case is more an aneurism of the first and second portions.[92d]

18—.—Shuck. No details obtainable (writer).

Wyeth says it was done three times and they all died.[93a]

On the same principle Butcher tied the carotid in one case, which ended fatally.[93b]

1863.—Butcher. Man, aged forty-two years. Tumor size of half of a large apple; the first portion diseased, and the innominate also; the right carotid was ligated three-quarters of an inch above its origin; two days later, sudden death; no clot in carotid; axillary filled with clots.[94]

*Extirpation of the Sac on the Right Side.*—There is one case only on record where extirpation of the aneurismal sac was resorted to on the right side, but it was for a persistent, solidified, or obliterated aneurism, by Franz Schopf, of Vienna.

Man, aged forty-six years; right subclavio-axillary aneurism of the size of a man's fist; is soft, yet elastic; no pulsation, no fremitus; upper extremity emaciated; movements limited and painful; no radial pulse; no œdema; no cyanosis, showing that the vein was free; trophic ulcer on the metacarpo-articulation of the little finger, of the size of a penny, communicating with the joint; it was thought that the tumor might be a neoplasm because the patient could not say if there had been pulsation or if the tumor had been softer or compressible; extirpation undertaken; is rather difficult, as the entire brachial plexus was intimately adherent to the sac; the pectoral muscle was divided transversely; the portion of the artery on the distal side of the tumor was obliterated and contracted to the size of a lead-pencil; the central portion of the vessel was of the size of the little finger and pulsating forcibly; it was ligated high up under the clavicle with strong silk; the axillary vein was separated with great difficulty without injury to its walls; finally, removal of the sac; it is a thick-walled aneurismal sac filled with firm blood-clots; primary union; persistence of fistula for three months; soon after the operation the ulcer healed with a good joint; pains and numbness disappeared; the use of the upper limb improved. Of course, if the tumor had caused no serious symptoms, it would not have been removed.[95]

*Amputation at the Shoulder-Joint on the Right Side.*—The operation proposed by Ferguson, amputation at the shoulder-joint and ligating the artery as close as possible to the sac (Erichsen), was performed five times with two recoveries (no side mentioned).[96]

It was done on the right side by Rose, with partial success. Rose also tied the carotid, and thus succeeded in saving his patient.[97]

FIFTY-SEVEN IDIOPATHIC ANEURISMS OF THE THIRD

| | Operations. | Operators. | Complications. |
|---|---|---|---|
| I | Needling. | Macewen. | . . . . . . . . . . . . . . . . . . |
| | | Nancrede. | . . . . . . . . . . . . . . . . . . |
| | | Bryant. | . . . . . . . . . . . . . . . . . . |
| II. | Opening of the sac and ligation of artery. | Syme. | Considerable hæmorrhage. |
| | | Smyth. | Terrific hæmorrhage. |
| III. | Proximal ligations. A. Ligation of the Subclavian. (1) Ligation of the third portion alone. I. | 1813. Colles. | Rapid gangrene. |
| | II. | 1823. Travers. | Hæmorrhage; needle had penetrated sac. |
| | III. | 1831. Brodie. | Suppuration. |
| | IV. | 1844. Green. | . . . . . . . . . . . . . . . . . . |
| | V. | 1851. Gore. | . . . . . . . . . . . . . . . . . . |
| | VI. | 1855. Blaker. | Hæmorrhage. |
| | VII. | 1856. Stanley. | Pleuritis. |
| | VIII. | 1857. Gregg. | Hæmorrhage; pyæmia. |
| | IX. | 1859. Drayton. | Phlebitis; coma. |
| | X. | 1860. Paget. | Hæmorrhage. |
| | XI. | 1858. Auvert. | Hæmorrhage; pneumonia. |
| | (2) Ligation of second portion alone. | 1826. Liston. | Enormous swelling; artery tied first in third portion, then in the second. |
| | | 1871. Gay. | Bronchitis. |
| | I. | 1826. Arendt. | Exhaustion (?) |
| | (3) Ligation of the first portion alone. II. | 1829. Bayer. | Hæmorrhage from rupture of the sac. |

Portion of the Right Subclavian Artery.

| Result. | Remarks. | References. |
|---|---|---|
| Contested. | Contra-indicated when the walls are thin. | |
| . . . . . . | . . . . . . . . . . . . | Charles B. Nancrede, Trans. Am. Surg. Asso'n, 1893. Vol. IX, p. 115. |
| . . . . . . | . . . . . . . . . . . . | J. D. Bryant, Am. Lancet, Detroit, January, 1893, quoted in Sajous's Annual, 1893. |
| Cure. | Difficulty in securing the ends of the artery. | James Syme, Med. Chir. Trans., London, 1860, Vol. XLIII, p. 141; also Syme's Operations of Clinical Surgery, p. 141; also quoted by Lefort in Dechambre's Dictionary, 1881; article "Subclavian Aneurism." |
| Death. | No time to find the opening of the artery. | Archives of Charity Hospital, New Orleans, La., 1876. |
| " | Subclavio-axillary aneurism; no clots on either side. | Guy's Hospital Reports, Poland, Vol. XV, p. 68; Wyeth's Essays, p. 176. |
| " | Subclavio-axillary aneurism | Guy's Hospital Reports, Vol. XV, p. 69; Wyeth's Essays, p. 178. |
| " | Subclavio-axillary aneurism. Coagulation on both sides of the ligatures. | Guy's Hospital Reports, Vol. XV, p. 69; Wyeth's Essays, p. 180. |
| Cure. | Tumor was small on the outer part of the artery; ligature close to the scalene. Was seen many years after the operation and was quite well. | Guy's Hospital Reports, Vol. XV, p. 70; Wyeth's Essays, p. 188. |
| Death. | . . . . . . . . . . . . | Guy's Hospital Reports, Vol. XV, p. 73; Wyeth's Essays, p. 190. |
| " | Subclavio-axillary aneurism, proximal end open, distal end full of pus. | Guy's Hospital Reports, Vol. XV, p. 70; Wyeth's Essays, p. 192. |
| " | Subclavio-axillary aneurism; purulent infiltration around wound. | Arch. klin. Chir., Bd. X, p. 232; Wyeth's Essays p. 192. |
| " | Cardiac end closed, distal end open. | Guy's Hospital Reports, Vol. XV, p. 72; Wyeth's Essays, p. 192. |
| " | Subclavio-axillary aneurism; artery closed on both sides | Am. Journ. Med. Sci., October, 1859, p. 402; Wyeth's Essays, p. 192. |
| " | Subclavio-axillary aneurism; sac suppurated; both ends closed. | Guy's Hospital Reports, Vol. XV, p. 70; Wyeth's Essays, p. 194. |
| " | Subclavio-axillary aneurism; rupture of artery at ligature. | Schmidt, Jahrbuch, Bd. XCVII, p. 341, 1858; Wyeth's Essays, p. 206. |
| " | Subclavio-axillary aneurism; both ends of subclavian open. | Guy's Hospital Reports, Vol. XV; Wyeth's Essays, p. 174. |
| " | No pulsation in artery when reached; thrombi on both sides of ligature. | Trans. Path. Soc., London, 1871, XXII, III; London Lancet, 1871, p. 22; London Lancet, May, 1871, p. 611; Wyeth's Essays, p. 176. |
| Death on fourth day. | No details obtainable. | Klin. Chir., Bd. X; Wyeth's Essays, p. 70; Gross's Surgery, 1882, Vol. I, p. 756. |
| Death. | Subclavio-axillary aneurism. | Guy's Hospital Reports, Vol. XV, Poland; Wyeth's Essays, p. 170. |

### Fifty-seven Idiopathic Aneurisms of the Third

| | Operations. | Operators. | Complications. |
|---|---|---|---|
| | III. | 1830. Liston. | Hæmorrhage. |
| | IV. | 1831. V. Mott. | Hæmorrhage. |
| | V. | 1835. Hayden. | Hæmorrhage. |
| | VI. | 1836. O'Reilly. | Hæmorrhage. |
| | VII. | 1841. Partridge. | Pyæmia. |
| | VIII. | 18—(?) Auvert. | Hæmorrhage; pneumonia. |
| | (4) Simultaneous ligation of first portion and of the common carotid. | 1838. Liston. | Hæmorrhage from distal end of subclavian. |
| | (5) Simultaneous ligation of first portion of common carotid and vertebral. | Sept., 1863, Willard Parker. | Hæmorrhage from distal end of subclavian. |
| | B. Ligation of innominate. I.<br>(6) Ligation of innominate alone. | 1818. V. Mott. | Suppuration; hæmorrhage. |
| | II. | 1822. Graefe. | Hæmorrhage. |
| | III. | 1824. Norman. | Hæmorrhage. |
| | IV. | 183–. Unknown; reported by Dupuytren. | Hæmorrhage. |
| | V. | 1830. Hall. | Hæmorrhage; pericarditis; aneurism-needle had partly transfixed artery. |
| | VI. | 1832. Bland. | Hæmorrhage. |
| | VII. | 1837. Lizars. | Suppuration; hæmorrhage. |
| | VIII. | 1856. Gore. | Erysipelas; terrible hæmorrhage. |

PORTION OF THE RIGHT SUBCLAVIAN ARTERY.—(*Continued.*)

| Result. | Remarks. | References. |
|---|---|---|
| Death. | Subclavio-axillary aneurism; central end of subclavian closed, distal end open. | Arch. klin. Chir., Bd. X; Wyeth's Essays, p. 170. |
| " | . . . . . . . . . . . . | Am. Journ. Med. Sci., Vol. XII; Norris's Contrib. to Pract. Surg; Guy's Hospital Reports, Vol. XV; Wyeth's Essays, p. 170. |
| " | Artery ruptured at point of ligation. | Arch. klin. Chir., Bd. X; Norris's Contrib. Am. Journ. Med. Sci., 1838; Wyeth's Essays, p. 170. |
| " | . . . . . . . . . . | Norris's Contrib. Am. Journ. Med. Sci., 1838; Wyeth's Essays, p. 170. |
| " | No clot on either side. | Norris's Contrib.; Guy's Hospital Reports, Vol. XV; Wyeth's Essays, p. 170. |
| " | Subclavio-axillary aneurism; proximal end closed, distal end open. | Guy's Hospital Reports, Vol. XV; Wyeth's Essays, p. 172. |
| " | . . . . . . . . . . . . | Guy's Hospital Reports, Vol. XVII; Wyeth's Essays, p. 172. |
| " | Proximal end of vertebral open. | Am. Med. Times, New York, March, 1864, Vol. VIII, p. 114; Am. Journ. Med. Sci., 1864, N. S. XLVII, 562; Wyeth's Essays, p. 173. |
| " | First portion diseased; innominate ligated ½ inch below bifurcation; innominate not closed on central side; on distal side, ulceration of innominate, carotid, and subclavian; subclavian pervious throughout; carotid not quite occluded. | New York Medical Repository, Vol. I, p. 1818; Norris's Contrib. to Pract. Surgery; Guy's Hospital Reports, Vol. XVII, Poland; Wyeth's Essays, p. 162. |
| " | First portion involved; innominate ligated 1 inch from aorta; proximal end closed, distal end open. | Graefe and Walther's Journal, Bd. IV; Guy's Hospital Reports, Vol. XVII, Poland; Norris's Contrib.; Wyeth's Essays, p. 164. |
| " | No details obtainable. | Ferguson's Surgery, p. 429, Phila., 1845; Norris's Contrib.; Guy's Hospital Reports, Vol. XVII, Poland; Wyeth's Essays, p. 164. |
| Death on third day. | No details obtainable. | Dupuytren, Leçon's Orales, 1834, p. 611; Norris's Contrib.; Guy's Hospital Reports; Wyeth's Essays, p. 164. |
| Death. | . . . . . . . . . . . | Norris's Contrib.; Baltimore Med. and Surg. Journ. and Review, 1833; Guy's Hospital Reports, Vol. XVII, Poland; Wyeth's Essays, p. 164. |
| " | Proximal end closed; carotid closed; subclavian open. | London Lancet, 1832, Vol. I, p. 97; Guy's Hospital Reports, Vol. XVII, Poland; Wyeth's Essays, p. 166. |
| " | Central end of innominate not entirely closed; subclavian pervious. | Norris's Contrib.; Lancet, Vol. II, p. 445; Guy's Hospital Reports, Vol. XVII, Poland; Wyeth's Essays, p. 166. |
| " | Central end of innominate only partially closed; both subclavians closed; carotid on right side open. | Erichsen; Guy's Hospital Reports, Vol. XVII, Poland; Lancet, July, 1878; Wyeth's Essays, p. 168. |

### Fifty-seven Idiopathic Aneurisms of the Third

| Operations. | Operators. | Complications. |
|---|---|---|
| IX. | 1856. Pirogoff. | Paralysis left side face; pleuritis; pneumonia. |
| X. | 1867. G. A. Porter. | . . . . . . . . . . . . . . . . . . |
| XI. | 1868. Bickersteth. | Hæmorrhage. |
| XII. | 1873. O'Grady. | Shock. |
| XIII. | 1882. Thompson. | Hæmorrhage from distal end. |
| XIV. | 1886. May. | Hæmorrhage. |
| (7) Simultaneous ligation of the innominate and common carotid. | 1868. A. B. Mott. | Hæmorrhage. |
| | 1893. Coppinger. | . . . . . . . . . . . . . . . . . |
| (8) Simultaneous ligation of innominate, common carotid, and vertebral. | 1884. Bull, New York. | Hæmorrhage. |
| | 1887. Durante. | Hæmorrhage; cerebral embolism on left side. |
| (9) Simultaneous ligation of innominate and common carotid, followed later by ligature of vertebral. | 1864, May 15. Smyth. | Distal hæmorrhage from vertebral. |
| (10) Simultaneous ligation of the innominate and common carotid, followed later by ligation of first portion of the subclavian. | 1885. M. Banks. | Hæmorrhage. |
| IV. Distal ligations<br>A. Simultaneous distal ligation of the third portion of subclavian and ligature of common carotid. | 1895. Monod. | Also dilatation of second and first portions. |
| B. Distal ligation of axillary alone. | Dupuytren. | Hæmorrhage from wound. |
| | Canton. | . . . . . . . . . . . . . . . . |
| | Pétrequin. | . . . . . . . . . . . . . . . . . . |
| | Shuck. | . . . . . . . . . . . . . . . . . . |
| C. Simultaneous distal ligation of axillary and common carotid. | Butcher. | . . . . . . . . . . . . . . . . . . |
| V. Extirpation of the sac. | 1891. Schopf, Fr. | . . . . . . . . . . . . . . . . . . |
| VI. Amputation at the shoulder. | Five times. | . . . . . . . . . . . . . . . . . . |

Portion of the Right Subclavian Artery.—(*Concluded.*)

| Result. | Remarks. | References. |
|---|---|---|
| Death after 48 hours. | . . . . . . . . . . . . . | Allgemein, Krieg's Chir., 1864, p. 459; Guy's Hospital Reports, Vol. XVII, p. 137; Wyeth's Essays, p. 168. |
| Death. | Clamp applied for three days. | Med. Press and Circular, Dublin, 1867, pp. 8, 131, 133; Burrell, Boston Med. and Surg. Journ., Aug. 8, 1895; Guy's Hospital Reports, Vol. XVII, p. 137, Poland; Wyeth's Essays, p 168. |
| " | A lead wire and clamp used at first, then two ligatures; clot firm on cardiac side in innominate; subclavian occluded; carotid open. | Lancet, Dec., 1872; Wyeth's Essays, p. 170; Med. Chir. Trans., Vol. LVI, p. 129. |
| Death after 20 hours. | . . . . . . . . . . . . . | O'Grady, Power of the Arteries, 3d edition, p. 49; Burrell, Boston Med. and Surg. Journ., Aug. 8, 1895. |
| Death. | . . . . . . . . . . . . . | Internat. Encyclop. of Surgery, Vol. III, p. 538; British Med. Journ , Vol. II, p. 722. |
| " | Ulceration on both sides of ligature. | London Lancet, 1866, Vol. I, p. 1064; N. G. Spencer, British Med. Journ., 1889, Vol. II, p. 79. |
| " | Sac had ruptured in pleura | Wyeth's Essays, p. 168. |
| Cure. | Section of carotid between two ligatures; strict asepsis. | London Lancet, 1893, Vol. III, p. 327; Med. Press and Circular, March 1, 1893; New York Med. Journ., April 8, 1893; Trans. Acad. Medicine, Dublin, 1893. |
| Death. | Double catgut. | Quoted by H. L. Burrell in Boston Med. and Surg. Journ., Aug. 8, 1895. |
| " | Wound had healed by first intention when patient died suddenly on fifteenth day; double ligation of innominate. | Private letter to S. F. Farmento, of New Orleans, La.; also to Walter G. Spencer, Brit. Med. Journ., 1889. Vol. II, p. 79. Detailed and connected account unobtainable in journals |
| Cure. | Return of aneurism ten years later; collateral circulation through intercostals and subscapular. | American Medical Times, 1864. |
| Death. | Pulsations returned strong on third day; later, ligation of first portion of subclavian. | British Med. Journ., 1885, Vol. I, p 230; Jacobson's Operations of Surgery, 1889, p. 484; Ballance and Edmunds, op. cit., p. 474. |
| Cure. | Pressure on common carotid diminished pulsations; tumor was small. | Bulletin de l'Académie de Médecine de Paris, Third Series, 8, 23, 29, January, 1895, p. 97. |
| Death on eighth day. | Artery ligated below the clavicle; no clot in artery; small opening in artery. | London Med. Gazette, Vol. IV, p. 321; Wyeth, Distal Ligature for Aneurism near Heart, Am. Journ. Med. Sci., 1881, p. 181; Internat. Encyclop. of Surgery, 1883, Vol. III, p. 517; also D. H. Agnew, Principles and Practice of Surgery, 1878, I, 594. |
| Death. | . . . . . . . . . . . . . | Idem. |
| " | Was more properly aneurism of first portion. | Idem. |
| " | . . . . . . . . . . . . . | Idem. |
| " | . . . . . . . . . . . . . | Butcher's Surgery, 1865, p. 855; Dr. Hayes Agnew, Principles and Practice of Surgery, 1878, Vol. I, p. 594; J. A. Wyeth, loc. cit., p. 181. |
| Cure. | . . . . . . . . . . . . . | Klinische Wochenschrift, No. 45, Sept., 1891. |
| Two recoveries. | In one of these cases Rose tied also the carotid and cured the patient. | Ashhurst's Surgery, 1893, p. 62; Rose in Internat. Encyclop. Surgery, Ashhurst, p. 511, Vol. VII, 1883. |

### DEDUCTIONS—RIGHT IDIOPATHIC ANEURISMS.

Thus, of fifty-six operated cases of idiopathic aneurisms of the right side, eight cases recovered: Syme, Green, Coppinger, Smyth, Monod, Schopf, and two amputations at the shoulder.

Out of forty-nine ligations of all kinds, four recovered (Green, Coppinger, Smyth, Monod).

Out of forty-three proximal ligations, three recovered (Green, Coppinger, Smyth).

In one of these recoveries three arteries were ligated, the innominate, common carotid, and the vertebral (Smyth).

Of eleven proximal ligations of the third portion, one only recovered (Green).

Of six distal ligations of the third portion and of the axillary, with or without simultaneous ligation of the common carotid, only one recovered (Monod).

The dreaded *complications* accountable for such appalling results are as follows:

In twenty-nine of the fifty-six cases hæmorrhage occurred.

In eleven there was sepsis, inflammation, erysipelas.

In one gangrene (Colles, 1813).

In two cerebral symptoms (Pirogoff, Durante).

In one shock (O'Grady).

### GENERAL REMARKS.

Here we must make a halt and meditate upon the following most remarkable and impressive facts.

The multiplicity of the operations, the ingenuity, and the boldness of the struggling surgeons deserve more than a passing notice. Their dogged and sublime obstinacy, their undaunted courage in combating this redoubtable disease and their fortitude under defeat, are most wonderful. Baffled at every turn and disheartened for a while they always rise again with the danger and gather new strength in presence of new perils. They always prove equal to them and devise new plans after each signalled failure. The disease is attacked in every conceivable way; one artery after the other is tied, first alone, then two, then three, and even four, increasing the number of ligatures as they are forced to recede. They hoped thereby to render success more probable, but they exhibited at the same time their apprehension, the anxiety in their own hearts. When repulsed by failure on the proximal side they then attack the unrelenting disease on the distal side, but with very little better results.

I.—All the ligatures of the subclavian inside the scalenes, or of the innominate and carotid (in traumatic as well as idiopathic aneurisms), have been almost all followed by lack of closure of the distal end of the subclavian, and by distal hæmorrhage.

II.—It is also remarkable that, although in some cases there was plenty of room for a clot or for occlusion, yet it did not take place.

III.—In the large majority of cases, the length of the right subclavian, from its origin to the point at which it branches, is from one to one and a half inches. (Irwin, cited by Sabine.)

May not abnormal branches account for this?

IV.—Out of two cases of ligature of the innominate, common carotid, and vertebral (Smyth, Durante), secondary hæmorrhage from the vertebral occurred in one (Smyth).

Also in the case of simultaneous ligature of the subclavian, common carotid, and vertebral by Parker.

V.—Lefort thinks that secondary hæmorrhage almost always occurs through the distal end, because the nutrition of the arterial walls of the distal end is inferior to the nutrition of the walls of the proximal end which receives its vasa vasorum directly from the centre, whereas the distal end receives them from the collateral circulation.[98]

According to Lister, the cause of the frequency of distal hæmorrhage is due to the smallness of the clot there; this in turn is due to the fact that it is undisturbed there.[99]

VI.—It is noticeable that Coppinger placed two ligatures on the common carotid and cut the artery between. It is the first time this was done in this region for subclavian aneurism.

VII.—In *résumé;* the ligation of the larger trunks, the innominate and common carotid, has given the best results (Smyth, Coppinger). When the largest and nearest collateral, the vertebral, was also tied the case where it was practised recovered (Smyth); whereas, out of two cases where the innominate and the common carotid alone were ligated (Mott and Coppinger) one only recovered (Coppinger).

## TREATMENT IN THE FUTURE.

The efforts of such experimenters as Lister, Wyeth, Senn, Ballance and Edmunds, have established beyond doubt that the proper course for the future is to ligate the artery aseptically with absorbable ligatures without rupturing the coats of the artery. All surgeons are now of the same mind, except Dr. Halsted, who prefers extirpation.

Therefore the following points from the admirable works of Wyeth, of Senn, of Ballance and Edmunds are of special interest and importance, and are set forth here for the benefit of all.

These points concern the vessel, the ligatures, the knot, the clots, the hæmorrhage.

*Remarks concerning the Vessel.*—The actual thickness of the outer coat of arteries is markedly thin in the subclavian, common carotid, and aorta (B. and E., p. 48). Arteries are very different, in life, from what they are on a fresh cadaver; few recognize the extreme tenuity of the arterial walls under natural circumstances (B. and E., p. 48).

When the tissues are undamaged, the much-dreaded nearness of the collateral branch is immaterial, and even suppuration in the wound is much less serious (B. and E., p. 163).

Diaphragm production is not related to the question of ruptured or intact arterial walls, but must depend upon some fault in the way the ligature is applied or to its too rapid absorption (B. and E., p. 219).

If a temporary ligature be removed at the end of seventy hours, the coats being ruptured, the adventitia will live and the vessel will not be divided (B. and E., p. 224).

To maintain the continuity of the vessel, the coats must not be ruptured and the wound must be aseptic; there is, then, no danger of hæmorrhage, for the vessel is whole and the new tissue forming around it only strengthens it (B. and E., p. 226).

Permanent obliteration of arteries takes place in from four to seven days; in veins from three to four days.[100]

We have removed several inches of the sheath from the carotid of horses before ligating, and have subsequently been unable to observe any difference, either by the naked eye or under the microscope, from those vessels in which the sheath had been left undisturbed. Senn's experience is the same (B. and E., p. 360

If a ligature be applied to a vessel and then immediately removed, the vessel will not, as a rule, be occluded, even if the coats are ruptured (B. and E., p. 366).

If a ligature, such as silk, be applied to an artery so as to rupture the coats and left on the vessel for seventy hours or more and then removed, the vessel will be occluded (Burns, quoted by B. and E., p. 366).

If a ligature be applied to an artery so that the lumen is greatly reduced but not absolutely closed, the vessel will nearly always be occluded (B. and E., p. 367).

The re-establishment of the circulation through the ligatured vessel is much more common nowadays than in the time o silk and rupture (B. and E., p. 437).

Rupture of the coats and septic operations in animals are followed by hæmorrhage as in man (B. and E., p. 15).

From experiments on the lower animals, it is clear that arteries can be permanently occluded without the rupture of any of their coats; to effect this with certainty it is essential to employ a suitable ligature, a suitable knot, tied with appropriate force, and to preserve the strictest asepticity (B. and E., p. 465).

In the case of Mitchell Banks, to be described later, hæmorrhage followed such a ligature of the subclavian; but the artery was thinned and dilated and the ligature applied one-half inch from the sac.

Ligature of the first portion of the right subclavian would be preferable to that of the innominate, for the cerebral circulation would not be materially interfered with (B. and E., p. 474).

If it be desired to ligate simultaneously the common carotid and the first part of the right subclavian, it is easy to reach them both through a single incision passing between the two origins of the sterno-mastoid (B. and E., 476).

It would be advisable first to arrange the ligatures with their knots loosely around the vessels before constricting either; tie the subclavian first; if the carotid be tied first, the pressure on the subclavian would be very high and the force required greater (B. and E., p. 476).

The surgeon should have a fair idea of the amount of force required to effect his object of occluding the vessel without rupturing its coats. He should experiment with human arteries distended with water to the pressure of the blood (B. and E., p. 515).

With this new method, subsidiary questions, such as the amount of clot formed, the presence of atheroma, and the nearness of the ligature to a collateral branch, sink into insignificance when the wall is left alone (B. and E., p. 523).

The degree of the disease, however, is important to consider; when the coats are simply infiltrated and thickened but not rigid and friable, the chances are at their best, but when the arteries are rigid or are more or less calcareous, or if the vessel is dilated or thinned, these conditions are bad (writer).

*Concerning the Ligatures.*—Senn says he never observed a single case in hospital or private practice where the catgut ligature failed to fulfil in the most satisfactory manner the purposes of a provisional hæmostatic agent until the definitive cicatrix had become sufficiently firm to resist the intra-arterial pressure.[101]

Catgut, Senn says, also appears to constitute itself a part and parcel of the vessel tissues until replaced by substitution, by a ring of organized tissue which serves as a material support to the vessel until cicatrization was completed, thus preserving the continuity of the vessel. All the remaining kinds of ligatures seem to act as foreign bodies, as far as the vessel tissues are concerned, and invariably produce a solution of continuity after a sufficient length of time has elapsed; they are usually found encysted in the mass of connective tissue, between and some distance from the ends of the vessel (B. and E., p. 267).

Senn found that the earliest time in which the loop became absorbed was twenty-one days, the knot alone remaining; after fifty-two days no trace of the ligature could be found (B. and E., p. 270).

By antisepsis alone the great arteries of the body cannot be ligated with absolute safety, as far as hæmorrhage is concerned, but this result may be expected when with asepsis is combined the employment of a suitable ligature so as to occlude the artery without damaging its walls (B. and E., p. 296).

Chromic catgut lasts long enough if no suppuration occurs, but if it does, owing to the cells working into the interstices of the catgut, it becomes rapidly absorbed and is not to be relied upon; this objection does not apply to kangaroo tendon which is absorbed only from the surface (B. and E., p. 377).

Silk and hemp stand boiling in perchloride of mercury solution, in which particular they are superior to catgut and tendon, and can thus be rendered aseptic, and then will not excite suppuration; becoming at first encapsulated and finally absorbed (B. and E., p. 378).

That the ligature may remain quiescent and not cause suppuration, it is necessary that it be aseptic (B. and E., p. 378).

The best method of preserving catgut and tendon (kangaroo) ligatures is in glycerin containing a 1 per cent. of perchloride of mercury; that is a far stronger antiseptic than carbolic oil; in glycerin the ligatures come out pliable and perfectly ready for use, whereas from oil they are stiff and unmanageable and require to be soaked for some time in a watery medium before they become sufficiently soft. Catgut can be kept in glycerin perchloride any length of time, but kangaroo tendon, after two or three months, swells up and softens (B. and E., p. 379).

In both silk and catgut there are fissures and cracks in which bacteria can lodge. Silk can be boiled, but catgut is destroyed by that treatment (B. and E., p. 379).

Wyeth boils the catgut in alcohol and softens it in sterilized warm water (writer).

When catgut is used much care must be given to its preparation. The surgeon cannot control its manufacture, but he is responsible for its asepticity (B. and E., p. 380).

As the outer coat and sheath of the artery consists chiefly of white connective tissue, the most appropriate ligature will be of this material,—*i.e.*, will be either kangaroo tendon or ox-peritoneum ligature; these satisfy all the tests; they are strong, inelastic, round, smooth, pliable, the proper size, slowly absorbable and easily rendered aseptic; of the two, peritoneum is slightly the better, as it lasts longer (B. and E., p. 381).

Boiled floss silk is a smooth and trustworthy ligature.

Failing these, ordinary silk and chromic catgut are good, but their rough surface and the presence in the latter of mucous and muscular tissues are defects. Ox aorta must be rejected on account of its weakness, bulk, and elasticity (B. and E., p. 381).

Senn prefers catgut (writer).

Senn recommends that two ligatures be used, the proximal being tied first. We found it good (B. and E., p. 393).

For the ligation of such large arteries as the innominate, first part of the subclavian, the common carotid, the iliacs, it would be probably advisable to use three ligatures combined into a stay-knot (B. and E., p. 512).

In using two ligatures there is less danger of rupturing the coats (B. and E., p. 445).

With respect to the force used in tying the ligatures, the first hitches of the reef and surgical knots are pulled until an obstruction is felt by the coats coming into contact; at the same time the pulsation in the artery beyond ceases; the knot is then completed (B. and E., p. 464).

The ligature should be made gradually tight until a pulsation is felt below, but none above nor in the aneurism, as the pressure beyond that degree may be dangerous (B. and E., p. 518).

As far as we know, there is no case on record in which a surgeon has ligated with an absorbable ligature one of the arteries usually tied with the intention of not rupturing the coats in which hæmorrhage has occurred (B. and E., p. 469).

The surgeon should hold himself responsible for the asepticity of the operation; also for all the qualities of the ligature, including its strength; the breaking of a ligature is a trying accident (B. and E., p. 515).

*Concerning the Knot.*—The best knot is the stay-knot (of two ligatures). It is made thus: Make on each separately and the same way the first hitch of a reef-knot (see p. 384), and tighten each separately so that the loop lies in contact with the vessel without constricting it; then taking the two ends on one side together in one hand, and the two ends of the other side in the other hand, constrict the vessel sufficiently to occlude it; finally complete the reef-knot. The simplest method of completing the knot is to treat the two ends in each hand as a single thread, and to tie as if completing a single reef-knot (B. and E., p. 396).

In no case in man has a stay-knot been employed for ligation in continuity (B. and E., p. 469).

In one case of amputation the stay-knot has been used for the femoral, which was much diseased, and all went well (B. and E., p. 469).

*Concerning the Clots.*—A clot is almost always present above and below when the walls have not been injured (B. and E., p. 145). But it takes no active part in the constructive process by which an artery is obliterated. Senn and all experimenters agree in this; some think these clots are an actual hinderance to the cicatrization, are as much of a foreign body as the clot on the flap of an amputation stump (B. and E., p. 161).

*Concerning the Hæmorrhage.*—It is probable that, except in those cases in which a large branch is given off just above the ligature, the hæmorrhage more frequently occurs from the distal end than from the proximal (B. and E., p. 293).

In none of the experiments on the lower animals did secondary hæmorrhage occur (B. and E., p. 464).

*Conclusions.*—To sum up: thorough asepsis, suitable aseptic ligatures (see above), suitable knot, suitable force; the over-denuding of the artery does not matter; nor the presence of a large collateral, nor a *slight* atheromatous condition.

## RETROSPECT.

It is most interesting to revert to the past and see the various suggestions which were offered, and are still offered, by operators for the cure of this terrible disease.

(1) Sabine had suggested the simultaneous ligation of the innominate, common carotid, vertebral, also of each branch of the thyroid axis and of the internal mammary. Also of any anomalous branches. In 297 cases the vertebral artery came only seven times nearer than usual to the origin of the subclavian (Sabine).

(2) Markoe had suggested the simultaneous ligature inside and outside the scalenes (Sabine), making sure to be inside the branches (writer).

(3) Wyeth advises to first try the ligature on the distal side, reserving the more dangerous operations on the side nearest the heart as the last resort.[102]

Wyeth recommends the following heroic treatment, remarking that it is not too much so for a ruthless disease. The innominate should be twisted after being tied, the carotid twisted in the same manner, and the subclavian tied near the innominate. All the collateral branches of the subclavian should be tied or twisted. Torsion is recommended especially in cases of wound of the subclavian.[103]

Twisting of the arteries diminishes tension and avoids the great risks of the ligature cutting through as a result of the constant pulsation and pressure brought against it.[104]

Torsion of the subclavian would occlude the vertebral, internal mammary, and the thyroid axis, which would obviate the necessity of their being tied, which should always be done when torsion is not being practised.[105]

If arteries are diseased, torsion would scarcely be safe.[106]

(4) Thompson proposed to ligate the innominate and then to make a longitudinal incision opposite the origin of the subclavian and, through the incision, insert into the artery a round ball of lead or some lighter substance, which we know to become encysted, and await results.[107]

(5) The writer has suggested the simultaneous ligature of the first portion of the subclavian or of the innominate, of the vertebral, and of the axillary above the subscapular; by this means the large avenues of supply are cut off.

(6) In case of threatened rupture of the sac the writer has

also suggested the ligation of the same arteries mentioned above, then opening of the sac; then plugging of the two ends of the subclavian with aseptic fine sponge; securing the other smaller vessels by ligature, or sponge plugging, or by stitching; if necessary the bleeding points should be encircled by an incision, and these small vessels cleared all around sufficiently to ligate them by using or not a curved needle and thread.

The previous permanent ligature of the large trunks is indispensable.

Smyth lost his case upon operating the last time by incision because he opened the sac and attempted to plug without previously securing the axillary, which, in that case, was the only large vessel that had not been tied.

The plugging of the proximal end of the subclavian with aseptic sponge, which may become engrafted, although it is ligated already inside the origin of its collateral branches, would be a possible guarantee against any failure of occlusion of the artery and of its other smaller branches.

It may be said that it is difficult to make sure that the proximal end is really plugged and not an anfractuosity of the sac, but we should plug all the anfractuosities thereabouts with bits of aseptic sponge which will become engrafted.

## Deductions as to Treatment.

In conclusion, we will say that strictest asepsis is the sheet-anchor.

The condition of asepsis is so important that all the cases of the pre-aseptic period ought to be left out in all statistics or comparisons.

Next to this, the best plan to pursue in the future is:

Ligate the first portion of the subclavian with a double, or better triple, non-contiguous, absorbable ligature without rupturing the coats (writer).

Senn was the first to recommend double ligation on the continuity of an artery.

He relies on the *bloodless space* between the ligatures for obtaining prompt and early obliteration of the lumen of the vessel. Also after amputations, as a rule, resting his advice on the experimental basis.

Senn's idea of applying double *non-contiguous* ligatures is truly most happy, important, and decisive, inspiring, as it does, a deep sense of security that never existed before.

It is preferable to ligate the first portion of the subclavian rather than the innominate, for the cerebral circulation would not be interfered with.[108a]

We should bear in mind Twyman's statement, that cerebral symptoms occurred three times in twenty-two cases,—*i.e.*, about 17 per cent.[108b]

When it is decided to ligate the subclavian and the common carotid simultaneously, it is best to ligate first the subclavian; otherwise the impulse against the subclavian would be much increased and might prevent the proper tightening of the ligature (B. and E., p. 476).

It would be safer to ligate the vertebral in like manner at the same sitting.

If that is not done, and if pulsations continue or return, it must be done.

We advise the above course because we do not believe that an artery can regain its patency after it has been so effectually obliterated by a double or triple catgut ligature tightened so as not to rupture the coats, but enough to stop all pulsations in the aneurism and the large efferent artery.

In the case of Mitchell Banks, to be related further, this repatency occurred, but it was because a single ligature had been applied, and on such a large vessel as the innominate.

In some of the successful ligatures, silk was used, and in most of them the coats were likely ruptured, yet the same occlusion can be obtained with as much certainty and less risk with absorbable ligatures when used *double* and especially *non-contiguous*,—*i.e.*, with a bloodless space between the two.

In some unsuccessful cases absorbable ligatures were used, but they were used singly.

It is especially when the vessel is found much enlarged and somewhat thinned that the double ligature is called for imperatively.

As regards the *choice of the operation*, we unhesitatingly advocate the resection of the inner extremity of the clavicle and of the adjoining part of the sternum. It is of the utmost importance that the ligations should be deliberately, systematically, and thoroughly done, and everything has to be sacrificed to that end, upon which depends the supreme aim itself. The recent case of Dr. H. L. Burrell is quite in point. Cooper, of San Francisco, had preceded him in 1859. Bardenheuer, who has repeatedly exposed the innominate and its branches by such an operation for removing tumors involving the root of the neck, says that those points can only be carried out by such resections of those bones.[108c]

We should also not lose sight of the fact that in idiopathic aneurisms, the *general condition of the patient* is defective, and, if time allows, before operating proper care should be taken to have him in as good general condition as possible. Whatever peculiar diathesis may exist in him should be properly counteracted, and his blood made as rich and plastic as possible, by careful diet, thorough rest, and proper medication.

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[TO BE CONTINUED.]

# THE LOCATION AND REMOVAL OF MISSILES FROM THE CRANIAL CAVITY.

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## I. The Location of Missiles in the Cranial Cavity.

THE traumatism of the bullet differs from that arising from any other cause, for the reason that, no matter how slight and apparently simple the injury, the element of concussion always enters into the case, and is to be added to the other existing symptoms. It is impossible to have a bullet injury without this added condition. Further, the concussion caused by fire-arm injuries of the head presents a much greater degree of intensity than can possibly be produced by any other means. The mere fact that the bullet strikes the head is sufficient to give rise to concussion; it need not enter the head or even produce appreciable injury to the cerebral mass. The immediate effects of even spent balls are those of concussion.

The primary symptoms of bullet traumatism, therefore, are those of general shock communicated to the nervous elements. This occurs irrespective of the particular part involved, and independently of the nature and extent of the injury.

The immediate effects of all bullet injuries of the skull, no matter what part of the skull is struck or brain injured, are manifested upon the medulla oblongata. Even without penetration of the skull or injury to the brain substance, in the concussion which follows the pneumogastric centre and the respiratory centre are at once inhibited or absolutely paralyzed. Those parts of the brain that have well-known localizing functions fail to give any evidence of their specific functions until the general signs of concussion have passed off.

This extraordinarily rapid suspension of the function of the respiratory centre is peculiar to gunshot injuries of the head. Its occurrence in connection with any other form of trauma is exceptional. The sudden failure of respiration in cases in which this occurs in comparatively slight injuries and in severe injuries in which the medulla is not directly or palpably injured cannot be explained in any other way.

It may be said in passing that there is reason to believe that the prompt application of artificial respiration may restore those functions that are so stupefied, so to speak, as to be incompetent to act intelligently, and that no person should be pronounced dead from a bullet injury to the head, other things being equal, unless artificial respiration has been tried and failed.

To sum up the symptoms which distinguish fire-arm injuries of the head from all other forms of traumatism, these may be stated to be as follows :

(1) The extraordinary rapidity with which the function of the respiratory centre in the medulla oblongata is inhibited or fails altogether. In the latter case the suspension of activity of the centre is like that of an engine caught "on the centre," from which point it cannot go on without assistance. This is supplied by artificial respiration, which may be successful, even after long intervals.

(2) The obscuring of every symptom by the prominence of the bulbar signs.

Another effect of the influence of concussion upon the medulla relates to the heart's action, which may be either retarded, as in moderate concussion, in which case cerebral anæmia produced by active contraction of the vessels will be present; or accelerated, as in intense concussion caused by severe laceration of brain tissue, and accompanying cerebral hyperæmia from paralysis of the vessels and loss of vascular tone.

The secondary symptoms of gunshot wounds of the head are of so varied a character as to be misleading, and they may be positively absent, as shown by the following case admitted to my service at St. Mary's Hospital, Brooklyn :

K. S., aged thirty-two years, stood before a mirror, and, taking deliberate aim, shot herself in the left temple with a 44-calibre revolver, just on a line with the top of the ear and about half an inch in front of the latter. The ball passed entirely through the head. She was brought to the hospital twenty-four hours later, perfectly conscious, with the statement from competent witnesses that she had never lost consciousness. She never complained of pain, nor was there, up to the time of her death from encephalitis forty-eight hours afterwards, paralysis of any kind.

The first point to be determined by the surgeon, when called to a gunshot wound of the head, relates to the possibility, when a fracture is found but no evidence of perforation exists, of the ball having passed through the bone between a depressed fragment and the adjoining sound bone, the former springing back from its natural elasticity after the missile has passed into the cranial cavity. Surgeons are familiar with the classical case of Von Bergmann, in which but a mere fissure existed at the point of injury, yet on autopsy a projectile was found in the brain. This fallacy has been commented upon and cases reported by König, and by Assistant Surgeon Howard, United States Army. It is more likely to arise in connection with gunshot injuries to the vault than elsewhere. In a case of my own which entered St. Mary's Hospital, the patient, a would-be suicide, shot herself in the frontal region, one and a half inches to the right of the interparietal, and about two inches in front of the fronto-parietal suture. What at first glance seemed to be the entire bullet was found beneath the scalp in the occipital region, but close inspection revealed the fact that a portion of the lateral surface was missing. A more careful examination of the point at which the ball struck the bone resulted in the discovery of two obliquely diverging fissures, with but a slight depression of the bone between. The trephine was applied just posteriorly to the point of junction of the fissures, and the missing portion of the missile was found, together with an attached portion of the internal table, embedded in the brain substance, within the area of opening furnished by an inch trephine. Other splinters from the internal table were also found, some of which bore lead markings.

Another fallacy consists in the existence of an opening of exit in cases of complete penetration, and still further emphasizes the importance of a close inspection of the bullet when it is recovered. In this connection an interesting case is reported by Lamphear.[1]

A man received a pistol-shot wound of the head, the ball striking one and a half inches to the right of the interparietal suture and about two inches posterior to the fronto-parietal suture. A wound of exit was found at the interparietal suture, the longitudinal sinus being injured in the passage of the bullet. The patient died, and the cause of death was found at the autopsy to be a cerebral abscess in the left cerebrum, just above the corpus callosum. The missing fragment of the bullet had passed through the right hemisphere, piercing the falx cerebri. The abscess was located at the point where the bullet was found.

Still greater difficulties may be encountered where the bullet enters from the direction of the cavity of the mouth. Here an immediate search should be made of the vault of the skull for projecting areas of the surface, or evidences of fracture. In this connection an interesting case is related by Gemans.[2]

A man, aged seventy-seven years, shot himself in the mouth, the bullet coursing upward and lodging just to the left of the median line, behind the fronto-parietal suture, where it produced a stellate fracture and bulging of the bone, plainly to be felt beneath the scalp. An incision was made and the fragments of bone together with the bullet removed. Walker[3] relates the case of a man shot in the mouth, in whom the wound of entrance was found to the left of the median line, behind the hard palate. A puffy swelling was discovered on the top of the head, through which a fracture could be made out. The scalp was turned back at this point, the fractured bone removed, and the bullet found lying beneath some blood-clot and lacerated brain substance.

If no bulging nor other evidences of fracture of vault are obtained, the surgeon will next turn his attention to the possibility of the bullet having lodged in the nasal fossa or one of the accessory sinuses. An interesting case of this kind was admitted to my service at St. Mary's Hospital, in which the patient had placed the muzzle of a small revolver against the hard palate, the bullet lodging in the right nasal fossa, from which it was removed.

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[1] Kansas City Medical Index, August, 1888.

[2] Pacific Medical Journal, April, 1890.

[3] British Medical Journal, March 12, 1892.

The ball may glance off from the bony structures of the base of the skull, or at the back of the pharynx, and lodge finally in the cavity of the mouth, or pass into either the œsophagus and be swallowed, or through the glottic opening, and enter either the larynx, trachea, or even the bronchi. In the first instance the patient may either spit it out or swallow it; if the latter, as well as when it passes down the œsophagus, it may be passed per rectum. Lodgement in the larynx will give rise at once to symptoms of suffocation, and necessitate immediate tracheotomy. If the ball passes beyond the larynx, if not of too large calibre, it will probably, by force of gravity, if its projectile force be spent, finally reach the bifurcation and lodge in one of the bronchi. The angle at which the left bronchus is placed to the trachea will favor its passage in that direction. When the ball reaches the cavity of the mouth by perforating the facial region, broken portions of the alveolar processes, together with detached teeth, may find their way in either of the directions indicated, and yet the bullet itself pass through the base of the skull.

The fallacy arising from the simultaneous reception of other injuries, which subsequently give rise to symptoms of cerebral disturbance, should not be lost sight of. In this connection the following case is of interest :

E. W., aged thirty-two years, was admitted to St. Mary's Hospital, November 30, 1894, with the following history : From early life he had been a "hard case." When a mere boy he was the leader of the "Cherry Hill Gang," and later in life he became one of the most dangerous and expert thieves in New York, attaining the title among his fellows and the police as the "prince of the light-fingered gentry." He was active in the pursuit of his calling until Tuesday afternoon, November 7, 1891, when, in a saloon brawl over election returns, he was shot in the head. The fight was general, but the evidence seems to be pretty clear that W. was lying upon his back with his fack looking towards his assailant when the shot was fired. The bullet went through the malar bone at its prominence. The hæmorrhage was profuse, and an ambulance was summoned, which took him to the Chambers Street Hospital, where he arrived about 6.30 in the evening. He walked up-stairs unaided and undressed himself. At this time his breathing was difficult and obstructive. This grew worse, and Dr. Stimson, hoping to recover the bullet as well as relieve his breathing, did a tracheotomy under an anæsthetic. Instead, however, of finding the bullet, the two back upper molars were removed from the trachea. The wound of the face and the track of the bullet were thoroughly explored by Dr. Stimson, but no trace of the missile could be found.

Upon the two days following he was very stupid ; this was attributed to the combined effects of the alcohol, which he had imbibed, and the anæsthetic. Upon the third day, on awakening in the morning, and attempting to get out of bed, he found he had no power over the left side ; he complained of difficulty of vision ; in certain positions he saw double. No trouble with the bladder or rectum. When examined later in the day by Drs. Starr and Walter Vought he was found to be suffering from left hemiplegia and left facial paralysis. No definite localization of the bullet was made, although it was thought the latter was in or about the inner capsule.

He remained in the Chambers Street Hospital until January, 1892. With the exception of the lower extremity, which improved to the extent of permitting him to go about, there was no change in his symptoms. While it seemed certain that he was suffering from the presence of the bullet in the brain, yet no definite localization could be decided upon.

Six months afterwards (May, 1892) he presented himself at the Polyclinic, and was carefully examined by Dr. R. S. Newton, lecturer upon nervous diseases at that institution. He was then found to be suffering from left hemiplegia and left facial paralysis. There was likewise paralysis of the left sixth nerve, and in addition *loss of taste*. There were no sensory defects. In commenting upon the case at that time, Dr. Newton propounded the following questions :

(1) If the hemiplegia and facial paralysis were due to the same focal lesion, why did the former improve and leave the latter at a stand-still ?

(2) Where in the brain could a lesion occur that would produce a hemiplegia combined with loss of taste?

(3) Was the combined loss of taste and sixth nerve paralysis to be taken as a sign of disease of the pons or base?

(4) Did the facial paralysis, loss of taste, and sixth nerve paralysis form part of the same process as the hemiplegia?

After careful study of the history and symptoms at this time, it was finally concluded by Dr. Newton that the facial paralysis was due to injury to the nerve, and that it had no connection with the hemiplegia, except in point of time; that the bullet entered the face, passed back, knocking out the teeth, and, meeting the temporal bone, became deflected, and passed across and up over the cavernous sinus to the clinoid process, where it cut out the sixth and seventh nerves. From here it had passed up into the white matter of the brain, and gave rise to the hemiplegia by pressure. Had the cortex been invaded, other symptoms, including convulsions, would have been present, which up to this time formed no part of the history of the case. Only in this way could be explained the loss of taste and the location of the bullet be removed from the pons or base.

One year later (May, 1893), he again came under Dr. Newton's observation. His face had improved in the meanwhile, so that he could close the left eye. The diplopia from the paralysis of the abducens had passed away. The paralyzed area had showed rigid contractions.

One extremely hot day in August, 1893, three months after the last observation and nearly two years following the injury, he was suddenly seized in Prospect Park, Brooklyn, with his first convulsion, for which he was taken to the Kings County Hospital. He was soon afterwards discharged. From this time until October, 1894, he had fourteen convulsions. These always began in the left arm and with movements of the globe, were accompanied by loss of consciousness, and were evidently cortical in origin. It now seemed apparent that the lesion had extended from the white matter to the cortex above, confirming the opinion previously held by Dr. Newton that the trouble causing the hemiplegia was in the motor convolutions, with facial, gustatory, and eye symptoms arising from injury, respectively of the trunks of the seventh (with its small filament to the lingual branch of the fifth) and the sixth or motor oculi externus, these being injured by the passage of the ball.

On December 24, 1894, he was placed under ether, and Dr.

Newton marked out upon the shaven scalp a space including the site of the top of the Rolandic area,—an experience in two previous cases in which the convulsions had been preceded by conjugate deviation of the eyes, leading him to believe the second frontal convolution, as well as the ascending frontal, to be involved, the area centre in these cases being placed higher up than the middle of the Rolandic area, and upon a plane with the leg centre in the posterior convolution. At about the middle of the area thus marked out, a small scar was now noticed for the first time, this showing the site of an old scalp wound. I turned back a U-shaped flap of scalp. Nothing abnormal in the exposed bone could be found. The trephine pin was placed as nearly as possible in the centre of the circle which had been marked out, and a one-inch button of bone removed. There was an absence of movements of the dura from cerebral pulsation, which at once attracted the attention of those present. Upon incising the dura a clear fluid escaped from a cyst cavity, the centre of which was located beneath the centre of the trephine opening. The capacity of this cavity was about a half ounce; it could easily accommodate a large English walnut. The cyst wall was smooth to the touch. An investigation of the neighborhood of the cyst was made by the finger palpating through the cyst wall. At one point, somewhat anteriorly and towards the median line, a point was felt which seemed more resistant to the touch of the finger in the cyst cavity. This was further explored by means of the telephone probe with a negative result.

As there was no tendency for the cyst wall to collapse, a small drain of iodoform wicking was passed to its most dependent portion and led out of the wound, the latter being closed except where the drain emerged.

Within forty-eight hours it was evident that the paralysis of the hand had improved; the sense of taste had returned. The drain was removed on the third day, and the scalp wound allowed to close. He persisted in visiting the water-closet for a movement of the bowels on the day following the operation. The course of the case was almost uneventful until the night of the ninth day, when, in spite of the application of a casing of plaster of Paris to provide against such a contingency, he removed this and the dressings to scratch his head. Upon the following day an erysipelatous blush appeared at a point where he had displaced the partly-healed flap; the blush extended, septic encephalitis set in, a fungus cerebri displaced the flap, and he died on the following day.

The autopsy was conducted by Dr. Newton eighteen hours after death with the following result:

(1) Purulent meningitis and encephalitis; fungus cerebri. Cyst well organized, polished, one and three-quarters inches deep, and from three-quarters to one and a quarter inches wide, extending through all the layers of the gray matter. No bullet was found in or about the cyst. All other parts of the brain examined and found to be healthy, save for the encephalitis.

(2) The brain was removed and the cranial bones minutely examined for entrance and exit of the bullet. The location of the scar upon the face indicated the original point of passage of the bullet, but no trace of entrance into the cranial cavity could be found. Every portion of bone was most scrupulously scanned, but no trace of the previous injury could be discovered. All the natural foramina were plugged, and the ether and light test applied. *All this proved negative; absolutely no evidence of the bullet ever having emerged from or entered the cranial cavity was present.*

Gunshot injuries of the facial region, the shot being fired from below and passing through the accessory sinuses may reach the cranial cavity, or they may stop short of this. In a case occurring in my own practice a boy was shot by a playmate, the bullet entering the antrum of Highmore. It was deflected from its course by impinging upon the lower margin of the orbit, and finally lodged in the spheno-maxillary fossa, where it was located by the telephone probe and removed.

Having positively determined that the bullet has perforated the skull, the next point to determine, if possible, is as to whether or not the dura mater has been perforated. The removal of a button of bone by the trephine, when the vault is involved, or enlargement of the original opening in the bone by the chisel and mallet, or Luers's cutting forceps, after preliminary shaving of a large area of the scalp and a proper disinfection of the surroundings, should be done preliminary to further search. The bullet may be found resting upon the dura, or between the dura and the inner table of the skull at the site of the wound, or at a point more or less remote from the original point of entry. This may occur in the case of a spent ball, or one which has lost its projectile force immediately after entering the skull. In this connection an interesting case is related by Saxer.[1]

> A soldier was struck by a musket-ball behind and above the left ear. He stated that the surgeons had probed for the ball, but it could not be felt. The wound remained open and suppurating for twenty years, the man complaining of pain and weight in the side of the head. He was frequently mentally deranged. He died of phthisis forty-three years after the injury. On autopsy the bullet was found to have entered the cranial cavity and to have turned sharply downward, lodging between the dura and the skull. The dura was closely adherent to the bullet; the latter had an irregular bony deposit about it.

The fact that a bullet may be fired from a weapon of good size, penetrate the skull, and yet not pass through the dura, is illustrated by a case reported by Bradford.[2] The bullet entered the parietal region, passed completely through both tables, made a half revolution upon its long axis, and was found lying with its butt-end upon the dura; it had not wounded the latter. In this case the bullet could not be found by the probe passed through the opening in the skull, but was discovered after trephining.

The dura mater may be injured by the splintered fragments of the inner table, the latter being driven into the substance of the brain, the bullet assuming an extra dural location. Walker[3] reports a case of this kind in a suicidal pistol-shot wound of the parietal region. The patient was promptly trephined and the ball and bone fragments removed. The wound was completely healed in nineteen days, the patient making a good recovery.

The ball may pass but a short distance into the brain substance and be identified by the surgeon's disinfected finger after trephining, the opening in the dura being enlarged for this purpose. Poirier[4] has reported the case of a boy, aged fourteen years, who shot himself in the left temple with a revolver. The skull was freely opened up at the point of entry the same evening, and the finger passed into the lateral ventricle detected the ball. It was removed and the boy made a rapid and, according to the report, complete recovery. In those cases in which the bullet passes but a short distance into the cerebral mass after perforating the skull and dura mater, and in which the velocity of the ball has been, to a great extent, lessened by its passage through the outer table, the splintering of the internal table seems to be greater than where the clean "punching" effect of a ball with high velocity is exhibited. Wills[1] relates the case of a patient in whom the penetration of the cerebral structures was comparatively slight, but a number of fragments had been driven in and were removed, as well as the ball. The patient, although conscious, was not given an anæsthetic. He recovered. In connection with this question the experiments of Delbet and Dagron[2] upon the conditions found in self-inflicted wounds, are of interest. These observers found, in nineteen out of forty-five cases of experimental shot-wounds at short range, that splinters of bone were carried in with the ball and scattered in the brain substance.

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[1] Correspondenzblatt für schweizer Aertze, Basel, September 15, 1891.

[2] Boston Medical and Surgical Journal, December 2, 1891.

[3] Medical and Surgical Reporter, Philadelphia, August 23, 1890.

Medical Press and Circular, London, July 13, 1892.

When both tables are broken, the greatest amount of damage is inflicted upon the inner table; this is according to "Teevan's law," that the fracture commences in the line of extension rather than in the line of compression. That this is not due to the greater brittleness of the inner table, as formerly supposed, but rather to the fact that the internal table receives the force of the bullet, plus the force conveyed by the outer to the inner table, is shown by the fact that, when the vulnerating force is applied from within, the outer table is the one that is most extensively splintered.

The ball may be found within the dura, and below the point of entry. Lamphear[3] operated upon a man who was shot one inch to the right of the median line, and one and three-fourths of an inch above the supra-orbital notch. A probe could be introduced three and three-fourths inches without difficulty. He was trephined after twenty-six hours, but the bullet could not be found until the wound in the dura had been enlarged, when it was discovered about three-fourths of an inch below the point of opening.

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[1] Medical Bulletin, Philadelphia, February, 1892.

[2] Bulletin de la Société anatomique, Paris, June 12, 1891.

[3] Kansas City Medical Index, August, 1888.

The question of the direction which the projectile may have taken in cases of deep penetration of the cerebral mass should receive careful consideration before attempts at locating the same, either with the finger or probe, are made. A ball, after passing through the vault of the skull, may lodge (1) in the substance of one of the hemispheres; (2) it may traverse both hemispheres and lodge at the opposite wall of the skull; (3) it may traverse both hemispheres and, reaching the opposite wall without force enough to penetrate it, turn back and after a recurrent course of from one to three inches lodge in the brain substance; (4) it may pass clear through (perforating gunshot injuries). As a further result of the experiments by Delbet and Dagron, above alluded to, it was shown that the direction of bullets entering the temporal region in suicidal cases may be such as to give rise to motor symptoms. The motor centre, situated highest and farthest back, is more likely to be injured, the ricochet being in that direction,

The probable direction of the ball, based upon the position which the fire-arm was held at the time of the shooting, should always be taken into consideration. Likewise, a thorough inspection of the opposite side of the head should be made for here, as in the case of shots fired from the direction of the cavity of the mouth, a perceptible bulging or other evidences of a fracture may be found at a point opposite the wound of entrance. Even the primary course which a ball takes after entering the cavity of the cranium must always remain uncertain, and the difficulties which surround the diagnosis are further enhanced by the fact that the ball may strike the opposite wall, become deflected at a greater or less angle, and finally lodge at a point remote from the line of its original passage. Fluhrer,[1] in 1884, reported a case in which he made a second trephining at the point of impact against the opposite wall, in order to trace the secondary course of the deflected ball.

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[1] New York Medical Journal, March 28, 1895.

In connection with the subject of rebounding of missiles from fire-arms and repenetration of the brain from these in pursuing a secondary course, it may be observed that Ruth[1] disagrees with Fluhrer's statement that the bullet may be deflected after passing through the brain and impinging upon the opposite side, and asserts that a ball will only rebound when flattened at least one-third, and that a velocity that will produce this amount of flattening will be almost certain to produce penetration of the skull at the point of impingement. According to this observer, if the ball strikes at right angles to the surface, or within fifteen degrees, and does not penetrate, the ball will be far more likely to lodge at the point of impact or very near thereto than to rebound. Repenetration, after striking the opposite wall of the skull occurs, according to Ruth, but rarely, and when deflection does occur, it is almost invariably at angles of more than ninety degrees to the angle of incidence.

The first attempts to search for the bullet in cases of complete penetration—*i.e.*, where both bone and dura have given passage to the ball—will consist of an exploration, by means of the finger, of the lacerated brain substance in the immediate vicinity of the wound in the dura. This may reveal the presence of splinters of bone, even if the ball itself is not located, and lead to the removal of these and prevent further mischief arising from their presence during the subsequent manipulation. Failing to identify the missile in this manner, the surgeon will at once consider the question of probing the brain. In this manipulation the greatest judgment is necessary, as is also the employment of the most delicate touch. A sharp-pointed instrument should never be employed, nor yet one of the pocket-case probes, which almost always find a place in the every-day emergency equipment of the surgeon. The search should be proceeded with deliberately, and only after full and complete ante-operative precautions of an aseptic character. The probe itself may be of any metal, but of whatever material made it should consist of a spherical or olive-shaped tip, mounted upon a slender shaft in order to minimize the friction in its contact with the collapsed bullet track and insure that all the resistance to be appreciated by the hand manipulating the probe is communicated from its tip. The amount of pressure to be employed consistent with safety will necessarily vary with the size and shape of the olive-shaped or spherical tip, the smaller and more wedge-shaped tip easily leaving the bullet track and passing between adjacent convolutions or into the brain tissues. For this reason the character of the weapon from which the shot was fired should be ascertained, if possible, and its calibre noted, in order that a proper-sized probe-tip may be selected for the particular case. A tip one-quarter inch in diameter will usually answer for any bullet from a 32-calibre up, and a three-sixteenths one will follow the track of a bullet from one of the smaller fire-arms. The amount of force to be employed, within the limits of safety, in propelling a probe along the supposed track of the bullet has been studied by Ruth,[1] who concludes as the result of his experiments that a probe-tip one-quarter inch in diameter requires from two and a half to three ounces weight to penetrate normal cerebral tissue, and from one and three-fourths to two ounces to cause it to pass between the convolutions. If smaller tips are used, the force must be proportionately lessened, but it will rarely be necessary to use a probe of less than three-sixteenths of an inch in diameter, which will require from one to two ounces pressure to penetrate normal brain tissue. The practical application of these experiments of Ruth would consist of either a device whereby the exact pressure in ounces, exercised at any time during the manipulation, could be seen at a glance, or the preliminary application of weight to the instrument, the surgeon depending upon the force of gravity alone to carry it along the bullet track to the termination of the latter at the site of the missile. The first would involve the use of a coiled spring which would first receive the pressure, and a graduated index to record the latter.

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[1] Journal of the American Medical Association, August 20, 1892.

Such an instrument has been constructed at my suggestion

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[1] Op. cit.

by Tiemann & Co., of New York (Fig. 1). It consists of a slender stem with an insulating covering of rubber designed to prevent error in locating the missile arising from contact with portions other than the tip. The stem has a bulbous tip which is designed to follow the track of a bullet from .22-calibre and upward. The handle is of hard rubber, is hollow, and slides upon the stem against the pressure of a spiral spring which surrounds the latter. The portion of stem seen projecting beyond the handle is for the attachment of the telephonic probe apparatus. An indicator upon the stem and a scale marked in fractions of an ounce upon the handle record the exact amount of force which is being exerted upon the probe within the limits of the compressibility of the spring. The latter is so arranged that it is within the safe boundaries prescribed as the result of Ruth's experiments. The upper extremity of the handle is made to unscrew for the purpose of cleansing.

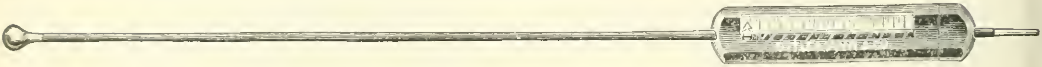

FIG. 1.—The graduated pressure brain probe.

The probe is to be used in the horizontal position, in order that the question of weight of the instrument and gravity need not enter into the consideration. The cord attachments connecting it to the telephonic apparatus should be made of aluminum, and be as flexible as possible in order to avoid embarrassment of the operator's manipulations by the weight or awkward movements of the cord. After trephining the skull and enlarging the opening in the dura the tip of the probe is introduced and passed in the supposed direction of the bullet. As long as the pressure made is within the limits of the spring, as shown by the indicator and scale, the probe is in the bullet track. As soon as the tip leaves the path of the missile this will be shown by an amount of force necessary to propel it forward beyond that which is necessary to compress the spring. In other words, as long as the surgeon is making pressure upon the probe with the spring intervening he is within the limits of force necessary to push the tip of the probe into the cerebral tissue or between the convolutions. As soon as the index shows that the compressibility of the spring has been overcome, or even when the limit of this has been almost reached, the probe is to be withdrawn for a short distance and another attempt made to follow the bullet track. The probe will not leave the latter without first giving warning by means of its indicator and index. Contact with the bullet or fragments thereof will be announced by the characteristic click in the telephonic receiver applied to the ear.

Attempts have been made to locate the exact position of the bullet in its relation to the surface and to indicate the exact point at which a counter opening may be made by the trephine. Morgan's[1] instrument consists of an inflexible meridian whose distal pole corresponds to the point of the proposed exit wound when the proximal pole is placed upon a properly introduced searching probe. The trajector is made of a solid bow of steel, in the end of which is a movable rod. The opposite end is arranged so as to adapt itself to any sized probe. A gravity probe is employed, and this is allowed to follow the bullet track until the depth and direction of the latter are ascertained, when it is steadied in position, the trajector placed upon it, and the movable rod pushed along it until it touches the scalp. The proper point for the application of the trephine will be indicated by the point.

Although a white porcelain tip whose surface is slightly roughened, in order to receive the markings of a lead ball, has been in use for many years, this is far inferior to the device known as " the telephone probe," for the introduction of which the profession is indebted to Dr. Girdner, of New York. With the improvement of probes insulated at all parts except the tip, in order to avoid the fallacy arising from contact of the shaft instead of the tip, and an arrangement whereby the receiver may be fastened to the head of the surgeon, instead of being held in the hand, both of which were suggested by myself in a paper presented at the meeting of the Association of Military Surgeons, held in Chicago, August 8, 9, and 10, 1893,[2] added to the fact that the telephone receiver of Graham Bell is no longer protected by a patent, should lead to the substitution of this instrument for the old porcelain probe in the armamentarium of every surgeon. In the German army the telephone probe is a part of the field equipment of the medical corps.

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[1] Indiana Medical Journal, September, 1892.

[2] Transactions of the Association of Military Surgeons of the United States, St. Louis, Mo., 1894.

It has been erroneously supposed that the telephone probe is complicated, and requires a battery for its operation. Nothing could be further from the truth. It simply involves the proper attachment of the connecting wires, and care that these do not come in contact with anything that will produce grating or clicking sounds, which, communicated to the receiver and thence to the ear of the operator, might interfere with a proper appreciation of the characteristic sound which announces the fact of contact of the probe with a metallic surface in the tissues. This peculiar sound will never be heard when the probe comes in contact with substances other than metal, of whatever nature these latter may be. This sound once heard will always be recognized and cannot be mistaken for anything else. No battery is required, and there is no complicated apparatus to get out of order or need adjustment. The principle upon which it is constructed is absolutely correct, and its application simplicity itself.

Finally, search for the bullet by means of a long, slender blunt needle passed through the cerebral substance, avoiding the sinus of the dura and the medulla, has been employed, although without success up to the present time. The toleration of the brain to this manipulation has been shown,[1] but the method involves too much risk for general application.

## II. The Removal of Missiles from the Cranial Cavity.

The large majority of those shot in the head upon the field of battle die upon the field, and never come under the surgeon's observation. This is particularly true of rifle-ball wounds of the head, the immediate mortality from which is very high, and which constitute by far the great majority of cranial fire-arm wounds received in active service. In civil practice, pistol-ball wounds predominate, and instant death is not so common but that almost every hospital surgeon, and many engaged in private practice alone as well, must meet with this class of injuries from time to time.

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[1] Brooklyn Medical Journal, June, 1888.

The large number of cases in which recovery has ensued without operation in bullet-wounds of the cranial cavity, particularly in cases of pistol-shot wound, on the one hand, and the generally supposed comparative infrequency of recovery in cases in which operative interference is instituted, on the other, seems to have thrown some doubt upon the justifiability of surgical intervention in this class of cases. Differences of opinion exist, therefore, as to the indications for operative interference other than the turning back of a flap of the scalp and trephining for the purpose of removing splinters of bone and the bullet as well, if within easy reach. Bearing upon this point the studies of Huhn[1] are of interest. This observer reported 423 cases of foreign bodies in the brain, of which 199 died and 224 recovered. Of the 199 fatal cases, the foreign body was removed in 48; in the remaining 151 cases the foreign body remained in the brain. A larger mortality percentage was found in cases where operative interference was not resorted to, as shown by the following figures:

| | |
|---|---|
| Fatal cases | 199. |
| Body removed in | 48, or 24.2 per cent. |
| Body not removed in | 151, or 75.8 per cent. |
| Non-fatal cases | 224. |
| Body removed in | 113, or 50.4 per cent. |
| Body not removed | 111, or 49.6 per cent. |

(In these cases the figures in removal and non-removal cases are about equal, and give results slightly in favor of removal.)

The mortality differs in different regions of the brain, according to Huhn, as follows: In the anterior cerebrum the mortality was 38.5 per cent.; in the middle cerebrum the mortality was 41.5 per cent.; in the posterior cerebrum the mortality was 43 per cent. Foreign bodies in the cerebellum invariably proved fatal.

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[1] University Medical Magazine, May, 1892.

The above statistics refer to foreign bodies in general. Limiting the inquiry to cases of bullets in the brain, it was found that, of 286 cases, 143 cases recovered and 143 died, a mortality of exactly 50 per cent.

Studies by Huhn directed to the question of the removal of the bullet gave the following result:

| | |
|---|---|
| Non-fatal cases | 143. |
| Bullet removed in | 56, or 39.1 per cent. |
| Bullet not removed in | 87, or 60.9 per cent. |
| Fatal cases | 143. |
| Bullet removed in | 112, or 78.3 per cent. |
| Bullet not removed in | 31, or 21.7 per cent. |

Of 168 cases operated upon, including cases in which the bullet was removed, as well as those in which it was not, 112 died and 56 recovered, showing a mortality of 66 or ⅔ per cent. Of 118 cases not operated upon, 87 recovered and 31 died, showing a mortality of 26.3 per cent.

Since the introduction of aseptic and antiseptic surgery, 60 cases have been reported, of which 24, or 40 per cent., died and 36, or 60 per cent., recovered. The question of removal or non-removal under aseptic and antiseptic treatment shows a decided gain in favor of the former above the figures previously quoted, as follows: number of cases occurring in the aseptic and antiseptic era, 60. Bullet removed in 24 cases, with a mortality of 16, or ⅔ per cent. Bullet not removed in 36 cases, with a mortality of 59, or $\frac{5}{9}$ per cent.

Huhn further studied the question of the mortality of cerebral abscess following foreign bodies in the brain. These all occurred in pre-antiseptic times and gave a mortality of 91 per cent.

According to Bradford and Smith,[1] when the bullet perforates (both entering and emerging) or is removed, the mortality is but 33.3 per cent. When it lodges or remains it is 54 per cent.

Commenting upon these figures, Bradford and Smith say, "These results are what would be expected, since, generally speaking, those bullets are removed by means of the trephine which have passed but a little way into the brain, the damage to the cerebral substance being slight and the ease and thoroughness of drainage far greater."

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[1] Boston Medical and Surgical Journal, October 15, 1891.

The recent literature of gunshot-wounds of the head is replete with instances of so-called recovery, in spite of the presence of the bullet. (Somers,[1] Park,[2] Corniere,[3] Mouchet,[4] Johnston,[5] Oetman, Jr.,[6] Wyman,[7] Winne,[8] Wheaton,[9] Cullen,[10] Cooge,[11] Drzewiccki,[12] and Radejewski, reported by Barry.[13])

The use of the word "recovery" requires a passing notice in connection with those cases in which the missile remained in the cranial cavity, and the patient is reported as recovered. Experience seems to show that, although there may be a subsidence of the symptoms, the presence of a foreign body in the brain must be regarded as a constant menace to the patient. The word "recovery," therefore, in this connection, should be used only with reference to the immediate result following the injury. Cases not uncommonly come under the surgeon's notice which have been previously reported as cured, in which the fallacy of hopes based upon an early subsidence of the symptoms is illustrated. The following case, reported by Colquhoun,[14] may be related in illustration :

Four years previously, the patient, then a young man of twenty, had shot himself in the head with suicidal intent. The ball was not removed, and the patient was reported as having made a good recovery. Later on he was subject to epileptiform convulsions, and became fickle, erotic, devoid of self-control, and unfit for work. When seen by Colquhoun he was unconscious, and in convulsions almost constantly. These latter continued with but slight intermissions, until he died, three days later. The autopsy showed a ragged and flattened bullet embedded in the inner table of the skull near the middle line in front, having traversed the brain substance, damaged several of the convolutions, impinging upon the inner table from within, and producing a fracture, as shown by a bony growth and adhesions between the brain, dura mater, and skull at this point.

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[1] Occidental Medical Times, Sacramento, April, 1892.

[2] Medical News, Philadelphia, December 3, 1892.

[3] Bulletin de la Société anatomique, December, 1892.

[4] Bulletin de la Société anatomique, February, 1893.

[5] Montreal Medical Journal, March, 1893.

[6] China Medical Missionary Journal, Shanghai, March, 1893.

[7] Detroit Emergency Hospital Reports, March, 1893.

[8] North Western Lancet, St. Paul, Minn., April, 1893.

[9] North Western Lancet, St. Paul, Minn., April, 1893.

[10] The Lancet, London, June 24, 1893.

[11] Southern Medical Record, Atlanta, Ga., August, 1893.

[12] Annual of the Universal Medical Sciences, Vol. III, 1893, Section A, p. 36.

[13] Hot Springs Medical Journal, January 15, 1893.

[14] Gazette des Hôpitaux, Paris, January, 1890.

One of the most remarkable cases, in which a foreign body remained in the brain for a long time without giving rise to serious symptoms, in the literature of the subject is related in the *Medical Press and Circular*, January 18, 1895, as follows:

A man entered the London Hospital complaining of pain in the head and drowsiness. He died suddenly a few days later, with symptoms of apoplexy. The post mortem revealed an abscess at the base, inside which a pen-holder and nib, measuring nearly three inches in length, were found. The nasal cavities and corresponding eye were carefully examined, but no trace of injury to these parts could be discovered to show the manner of entrance of the foreign body into the cavity of the cranium. The man was thirty-three years old, had been married a number of years, but the widow had never heard him allude to any injury which could account for the presence of the pen-holder and nib.

At a meeting of the Brooklyn Surgical Society, held February 2, 1888, there was related the case of a lad who had been injured by a missile from a ten- or twelve-inch toy cannon. The missile, a stone, was as large as an almond, and entered the cavity of the cranium just above the groove for the right lateral sinus. An exploratory trephining was done the next day, but the foreign body was not found. The operator, in concluding the narration of the case, remarked, "He lived some eight or ten years and then, finally, died of tuberculosis of the lung; he made good progress in his studies, and was a bright, active business lad." While it is true that this boy was bright and active, it is also true that he came under my observation not less than three years before his death for Jacksonian epilepsy, but operative interference was declined by the parents. The next information I had concerning him was the announcement of his death, several weeks before, from pulmonary tuberculosis.

In another class of cases the occurrence of symptoms from which apparent recovery takes place, but in which one or more relapses occur, with a final fatal issue, is illustrated in the following cases:

Froelich[1] relates the case of a student, aged twenty-one years, who came under his observation in an unconscious condition, with a revolver wound of the right temple. Search for the bullet proved unsuccessful, and he was discharged at the end of three weeks, apparently well, save for loss of vision in the right eye. Nine months afterwards he was attacked with violent pains in the head and died in coma on the nineteenth day. At the autopsy it was found that the bullet had entered the orbit, tearing away the optic nerve in its passage, and lodged on the under surface of the orbital plate of the frontal bone, where it was found embedded in a mass of callus. The entire base of the brain, on both sides, medulla oblongata, and upper portion of the spinal cord were bathed in pus; the ventricles were full of purulent fluid.

Battle[2] reports, among other cases, that of a boy who received a bullet wound of the skull from a small revolver. The wound of entrance was two inches above and one and one-half inches in front of the left auditory meatus. Double optic neuritis occurred, and on the third day an exploratory trephining was done, but the bullet was not found. The neuritis slowly improved until recovery apparently took place, and a fungus cerebri, which had developed in the meanwhile, disappeared. He was kept under observation at the hospital for four months, however, and was then discharged. Four weeks later epileptic seizures came on and he was readmitted; five weeks later the optic neuritis had again developed. He died about nine months from the time of the injury. The autopsy showed a thick-walled abscess cavity. The bullet was found low down in the right frontal lobe, at some distance from the abscess cavity, and surrounded by apparently healthy white cerebral tissue. There was no track to show the course the bullet had taken to reach this spot.

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[1] Münchener medicinische Wochenschrift, August 25, 1891.

[2] British Medical Journal, July 12, 1890.

In debating the question of the advisability of a thorough search for and removal of missiles from the cranial cavity, the additional damage which this will inflict upon the brain is to be taken into account. The surgeon should bear in mind the fact that, with the exception of cases in which the ball has passed through the brain and lodged in the bone of the opposite wall of the skull, from which it has been removed by a counter-opening, and those in which it has passed but a short distance into the cerebral tissues and has been found to be readily within reach, as well as those instances where it has lodged between the dura mater and the skull, the location and successful removal of a missile from this region is of rare occurrence. On the other hand, it may be said, as stated by Bradford, that "the general surgical instinct which prompts attempting whatever offers a possibility of success in cases where death seems certain," will favor operative interference, with the view of the removal of the bullet.

In any event there can be no two opinions as to the necessity for (1) shaving the scalp far and wide of the opening of entrance and also that of exit; (2) scrubbing, with a stiff brush and soap and hot water, of the entire head; (3) disinfection of the external parts by means of a mercuric chloride solution, or some trustworthy germicidal antiseptic; (4) turning back of a flap of scalp to thoroughly expose the wound in order to furnish sufficient room for subsequent manipulation, and to provide for drainage; (5) enlarging the opening in the dura, which is usually smaller than the bullet, in order to turn out clots, facilitate the search for and removal of splinters, as well as the bullet itself, and afford drainage to the lacerated brain substance. Further operative treatment, which has the sanction of many practical surgeons of the present day, consists in (6) making a counter-opening in the skull in cases in which the bullet can be traced at a point more or less remote for the purpose of making further search for and removing the bullet, treatment of a fracture, and providing through-and-through drainage.

In this connection it is interesting to note Von Bergmann's[1] remarkably conservative opinion, in view of the operative boldness which has characterized German surgery since the advent of aseptic and antiseptic wound treatment. He declares that in shot-wounds of the skull the wound should be closed, exactly as in wounds of the knee-joint, and protected against further injury. When no symptoms are present, no operative interference is necessary; but immediate and severe symptoms of irritation, such as contractions, epileptiform convulsions, monoplegia, etc., justify operation. If, however, the symptoms of irritation occur later, trephining is not advised.

Having trephined the skull in such a manner as to include in the trephine-opening the wound in the bone, and to afford an opportunity for the removal of the *débris* from the scalp, hair, etc., and, perhaps, wadding from the cartridge, and located the bullet, the latter is to be grasped by some form of forceps and removed. Where the missile lies between the dura and the skull, this can usually be effected with the thumb-forceps, hæmostatic forceps, or a curette or small scoop. If it lies in the cerebral substance and can be detected by the finger, these means are also applicable. Where, however, it lies at a greater depth, some one of the specially designed bullet-forceps will be required. Of these several models are made by the instrument-makers, the one best adapted for the purpose is that known as the Tiemann double-jointed bullet-forceps (Fig. 2). While under ordinary circumstances there is no particular objection to the stretching of the bullet track, which the opening of the jaws involves in the use of the ordinary bullet-forceps (Fig. 3), this becomes a matter of

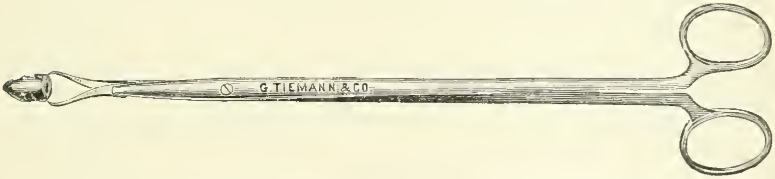

FIG. 2.—Showing the comparatively small amount of space required in using the newer pattern of bullet-forceps, with double joint.

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[1] Münchener medicinische Wochenschrift, June 27, 1893.

great importance when the manipulations are made along a track which leads through brain substance. Here every impingement by the forceps upon the wall of the channel made by the bullet may, and generally does, mean fresh injury to the cerebral tissues.

Where the telephone probe apparatus is at hand, the electric bullet-extractor, devised by Medical Inspector Wells,[1] United States Navy, may be employed. This is attached to the connecting wire in place of the probe, and announces by the characteristic click heard in the receiver when the instrument is in contact with the missile, if the latter be of metal. The special model of bullet-extractor, which has been selected for this application of Dr. Girdner's principle by Dr. Wells, is such as to permit of its use without the electrical attachment.

While performing the necessary movements in the extraction, these should be as gentle as possible. Rapid withdrawal of the missile is neither necessary nor desirable; a sudden jerk of a ball roughened by its passage through the rifled bore of a modern fire-arm, or more or less flattened by its passage through the bone at the wound of entrance or against the bony wall of the opposite side of the skull, may inflict almost, if not quite, as much damage upon the cerebral tissue in the withdrawal as in its original flight.

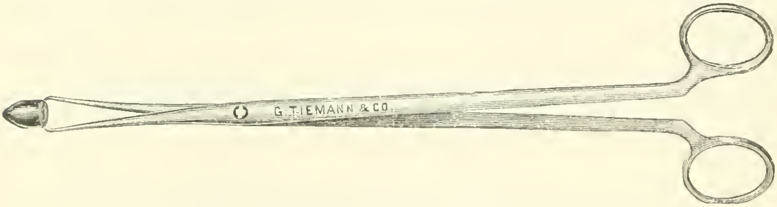
G. TIEMANN & CO.

FIG. 3.—Showing the increased space necessary, and consequent compression of brain tissue in extracting a bullet from the brain with the old-fashioned bullet-forceps.

While the use of the ordinary mercuric chloride solutions is permissible for purposes of disinfection in all extradural injuries, even the weakest solution of this agent, or even carbolic acid, is to be avoided when the cerebral substance is exposed. Adamkiewicz[2] has shown by experiments upon dogs that the weakest solutions of these (1 to 10,000 of the first and 1 to 200 of the last named) of any service for the purposes of asepsis or antisepsis, produce deleterious effects upon the brain substance, particularly when this is lacerated. It therefore becomes necessary to substitute either simple sterilized water, a sterilized normal salt solution (6.5-per-cent. solution: Tavel), or, at the most, a 3-per-cent. boric acid solution (Adamkiewicz), made with sterilized water, for the stronger irrigating fluids.

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[1] Medical Record, New York, January 5, 1895.

[2] Deutsche medicinische Wochenschrift, January 12, 1893.

The arrest of hæmorrhage is of importance in gunshot wounds of the brain,—so much so that operative interference is justifiable from this point alone, irrespective of the removal of the missile. In Bradford and Smith's statistics, out of fifty-nine cases, death was caused by hæmorrhage in ten where no operation was performed, and in but three cases where an attempt was made to remove the bullet. The importance of arresting hæmorrhage relates, however, not so much to the threatened loss of life from actual loss of blood, as to those dangers that may arise from increasing pressure of blood poured out within a cavity with unyielding bony walls. This latter, while it serves to limit the bleeding within the danger-point of death from hæmorrhage, may, from its pressure effects, increase the shock, and, by inducing degenerative or destructive changes in nerve substance, lay the foundation for future mental impairment in cases which otherwise recover.

After enlarging the wound in the dura, if any vessels in this structure are found to be bleeding, they may be caught up with hæmostatic forceps and ligated. All clots and devitalized tissue having been removed from the bullet track by irrigation and the gentle use of a scoop, the bleeding will frequently be found to have ceased; if not, a tampon of iodoform gauze is to be carefully introduced into the opening in the brain or against the lacerated surface. The amount of gauze which can be introduced without of itself producing pressure symptoms is considerable. The gauze should be applied in the shape of a narrow continuous strip, which has been doubled in its lengthwise direction with the edges turned in at the middle, and secured by a line of stitching. The object of this is to prevent the strip from fraying and leaving threads of the gauze behind in the brain upon withdrawal of the tampon.

The occurrence of severe and persistent hæmorrhage, as shown by the appearance of the blood from the wound through the tampon, or progressive increase in the compression symptoms may be met by ligature of the carotid artery. Secondary hæmorrhage due to changes in and about the wound arising from septic infection is to be treated by ligation of the bleeding vessel, or this failing from inaccessibility of the latter, or the impossibility of getting a ligature to hold upon softened tissues, ligation of the external carotid, if the bleeding is from one of its branches. Experience shows that this is a safer operation than ligation of the common carotid and more effective in controlling the hæmorrhage.

Drainage is to be effected by means of strips of gauze while bleeding is in progress, and by soft rubber drainage-tubes when there is no hæmorrhage. The tube may be made to pass entirely through in those cases in which perforation takes place. Otherwise its introduction for a distance of an inch from the wound in the dura will serve the purposes of drainage.

The external wound is to be closed completely except at the point where the drainage-tube passes out. An aseptic dressing is applied and held in place by a roller bandage which should include the entire head, particular pains being taken to include the occiput low down; a few turns should pass beneath the chin. The restlessness of the patient will sometimes necessitate the application of a plaster-of-Paris bandage over all.

The patient is to be placed at absolute rest and kept upon a light but nutritious diet. Stimulants may be given if absolutely necessary. If a rise of temperature occurs, it is probably due either to septic meningitis or infection of the external parts. In case encephalitis develops and is not controlled by removal of the dressings and careful cleansing, it is recommended to bleed from the jugular vein (Huhn).

# POST-TYPHOID BONE LESIONS.

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AMONG the sequelæ of the continued fevers, the lesions of bone have long occupied a place of prominence. In the Toner Lecture, 1876, W. W. Keen quoted forty-one cases, thirty-seven of which had followed typhoid fever. He remarks that "typhoid as usual claims the larger share," inferring that such had been the experience of those before him. In the same year Sir James Paget described most fully, from the clinical standpoint, an inflammatory condition of bone occurring at various periods after typhoid fever, pursuing a more or less chronic course, with but little tendency to spontaneous recovery, except after long periods of time. He had observed some seventy cases, all after typhoid fever.

Prior to these observations, Murchison[1] reported necrosis of femur, tibia, and temporal bone following the same disease, and, later, Affleck described periostitis of humerus in two cases, and of the tibia in another.

Hayward[2] reported several cases, one of which did not go on to necrosis; also one of multiple lesion.

Jackson[3] observed periostitis of rib with necrosis occurring two months after typhoid fever, with recovery after seven months.

With the identification of the Eberth-Gaffky bacillus as the specific cause of typhoid fever, the nature of these bone lesions has been investigated more thoroughly, with results which have established a relation between them and the primary typhoid attack.

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[1] Continued Fevers of Great Britain, 1873, p. 582.

[2] British Medical Journal, Vol. 1, 1885, p. 16.

[3] British Medical Journal, Vol. 1, 1885, p. 428.

Ebermaier,[1] in 1887, obtained from two cases of suppurative post-typhoid periostitis the bacillus of Eberth in pure culture. Orloff,[2] in 1889, in a similar case of periosteal abscess, six months post-typhoid, found this bacillus alone. Achalme[3] cites a case of periosteal abscess of tibia, the pus of which showed only the typhoid bacillus; and Melchior[4] found this organism alone in a periosteal abscess of the tibia occurring ten and a half months after the attack. Golgi and others have had similar experience. In these cases the bacillus of Eberth was regarded as the sole infective agent.

At about the same time Pean and Cornil[5] reported a case of necrosis of the tibia, occurring eight months after recovery from typhoid fever, examination of which showed the typhoid bacillus associated with other organisms.

Fashing[6] reported a somewhat similar case, in which staphylococci alone were found.

E. Fraenkel[7] found pyogenic organisms associated with the typhoid bacillus. He does not think that the typhoid bacillus plays an important *rôle*, but holds that the condition is one of secondary infection by the pyogenic cocci, and where these have not been found they have died out or the culture medium has not been suitable.

From time to time a large number of cases have been observed, varying more or less in the character of the infection. Thus, Achalme, Melchior (as above stated), Sultan, Chantamesse, Widal, and others, have reported cases of pure typhoid infection. Klemm speaks of a mixed infection, with the colon and typhoid bacilli; and one of our own cases showed the typhoid bacillus associated with the staphylococcus pyogenes citreus.

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[1] Deutsches Archiv für klin. Med., Bd. XLIV, p. 141.

[2] Centralbl. für Chirurg., May 24, 1889.

[3] La Semaine Médicale, 1890, T. X, p. 224.

[4] La Semaine Médicale, 1892, T. XII, p. 304.

[5] Bull. de l'Académ. de Méd., 1891, No. 15.

[6] Wiener klinische Wochenschrift, 1892, No. 18.

[7] Baumgarten's Jahresbericht, VI, p. 225.

There are many cases on record in which the infection has not been with the typhoid bacillus, but with the pyogenic cocci, or the less frequent pus producers. Netter describes eleven cases of ostitis, five of which showed the pneumococcus, one the pneumococcus and staphylococcus, and five the streptococcus.

While it is certain that mixed infections do occur in these post-typhoid bone lesions, it must be admitted that the evidence of careful bacteriological investigation, based upon a considerable number of cases, is to the effect that these lesions may be caused by the typhoid bacillus alone.

The question of the pyogenic properties of the typhoid bacillus is of great interest in connection with these sequelæ of the fever.

Orloff produced suppuration in dogs and rabbits by subcutaneous inoculation of pure typhoid cultures, the pus showing this organism alone. Adenot,[1] by similar inoculation, caused pus formation in the subcutaneous tissue of dogs and rabbits, the typhoid bacillus was separated in pure culture.

Of greater interest, in the consideration of bone lesions, are the experiments of Golgi, who fractured a long bone in one of the lower animals, and at some distance from that point injected subcutaneously a suspension of pure typhoid bacilli, with the production of suppuration at the point of fracture; the pus showing in culture only the typhoid bacilli.

The presence of the typhoid bacillus in the spleen and bone-marrow, particularly of the ribs, has been demonstrated by Quincke as late as the seventh week of the disease. In nine cases examined, eight showed the organism in the marrow of the ribs. In two cases the sternum was examined with positive results, and in seven out of eight cases large numbers were found in the spleen pulp. By analogy they should be as frequent in the bone-marrow as in the spleen. The autopsy records of the Johns Hopkins Hospital show many instances in which typhoid bacilli have been found in the different organs of the body, in the bone-marrow and bile.[2] Dr. Welch has observed their persistence in the bile of a rabbit which had been inoculated four months previously and had recovered ; they were not found in the organs. As showing the tenacity of life of the organism, Schiller implanted the bacilli on a silk thread, and at the end of one year they were found still living. According to the same author they can exist on a potato culture for two years.

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[1] Archiv de Méd. expérimentale, T. I.

[2] Flexner, Journal of Pathology and Bacteriology, April, 1895.

Uffelmanm found the bacilli alive in dry sterile sand at the end of eighty-two days.

These points throw some light upon the occurrence of post-typhoid bone lesions at periods long after the primary attack, which, as will be seen later, is one of the striking clinical features. It is, moreover, on these grounds that the theory of mixed infection is based,—that the entrance of pus cocci upon a soil already vitiated by the presence of the typhoid bacillus determines the suppuration, the pus organisms later dying out and leaving the bacilli alone in the focus, but it is an open question as to whether or not this really does occur. The experiments of Klemm have a very significant bearing upon this point. Into the ear vein of a rabbit he inoculated a pure culture of typhoid bacilli, and seven days later, in the same animals, and in the same manner, inoculated a pure culture of staphylococcus pyogenes aureus, with the result that an osteomyelitis—with, in one case, separation of the epiphysis—was set up, cultures from which showed the staphylococcus pyogenes aureus alone. Again, by the inoculation of both organisms together he produced an osteomyelitis of the ilium, cultures from which also showed staphylococcus pyogenes aureus alone.

The problem of the etiology of the post-typhoid bone suppurations appears to be twofold. Observations upon suppurative processes in human beings, developed during or subsequent to an attack of typhoid fever, indicate that at one time the ordinary pyogenic organisms are alone present, at another, associated with the typhoid bacillus, and in still others the typhoid bacilli alone are met with, and even more rarely the typhoid bacilli are found together with other bacteria,—*e.g.*, bacterium coli commune. It is not necessary that there shall be a common etiology in these processes any more than we look for a common cause of suppurative processes occurring under other conditions in the body; on the other hand, there seems to be no good reason for excluding the typhoid bacillus from the group of possible pyogenic micro-organisms. It may be looked upon as capable of causing various pathological conditions,—a specific typhoid fever attack, a local suppuration, and, finally, a general septicæmia, as in a case which recently occurred in this hospital and was reported by Dr. Flexner.[1] The pyogenic organisms are often present in the intestine, and it is not surprising that they should also, at times, penetrate the interior when a ready means of entrance is afforded by the open ulcers present.

During the past year six cases of post-typhoid bone necrosis have come under our notice. Four were admitted to Dr. Halsted's service in this hospital, to whom I am indebted for the privilege of reporting them. The other two we were able to study in private practice through the kindness of Dr. Osler and Dr. Finney.

Case I.—A. T., aged thirty-five years, cigar-box maker, admitted to Ward E, March 19, 1894, with a discharging sinus over left costal margin. The family history was negative. Inquiry into the previous history revealed no serious illnesses. There was no history of venereal infection. He had typhoid fever in August, 1893, the attack lasting three months. During convalescence, and while still in bed, patient suffered from what he describes as constant sticking pains over left costal margin, more or less severe, to which the attention of the physician in attendance was frequently called.

In November—*i.e.*, one month after recovery from attack, the pains however persisting,—there appeared an inflammatory area over the left costal margin, high up towards the xiphoid cartilage. There was no cough, no dyspnœa.

In December an incision was made into the tumor, blood escaping (according to the patient's description), after poulticing for some time a purulent discharge appeared, which has persisted.

On admission the general condition was good. Examination of the thoracic and abdominal organs was negative. There were no glandular enlargements; the note on condition of chest-wall is as follows:

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[1] Journal of Pathology and Bacteriology, April, 1895.

Midway between xiphoid cartilage and the left nipple is a bright-red inflamed area, two by two centimetres, and in the centre of this the opening of a sinus. A probe passes three centimetres into the sinus backward and downward to the cartilage of the seventh rib. Around this inflammatory area the tissues are denser than normal and slightly painful to the extent of ten centimetres from above downward, and eight centimetres laterally. Highest temperature record 99.5° F. Urine was negative; no diazo reaction.

Operation March 22, 1894. Dr. Bloodgood. The granulation tissue was found behind the seventh costal cartilage, which was perforated. Posterior periosteum was not incised, but curetted. All diseased soft parts removed. The wound was irrigated and loosely closed. The cartilage was perforated in three places from cavity to sinus.

By March 26 some of the stitches were removed. Wound in central part gaping; slight bloody discharge. The wound showed little tendency to granulate.

April 2. Patient was discharged. The sinus was still present, discharging a brownish pus.

April 6. Patient returned for dressing. A swelling was noticed over the left costal margin below wound of former operation. Healthy tissue separates the two. There is pain in the swelling and in lower part of back on same side.

April 12. Patient readmitted to hospital. Wound of former operation looking well, granulating from bottom well; sinus still discharging; swelling over costal margin below is as at last note, but more painful. There is no redness, no œdema; severe pain in back and left side low down.

April 15. A friction murmur was heard just above the swelling; fluctuation was evident in tumor; pain was not so severe as at time of last note.

April 19. Pain in swelling much greater; fluctuation more marked; friction murmur no longer heard.

April 19. Operation: Dr. Finney. Excision of old sinus and some cartilages; opening of abscess over costal margin; much thick greenish-yellow pus evacuated; wound irrigated (1 to 1000) hydrarg. bichlor. solution; packed with iodoform gauze. Shortly after operation the patient left the hospital, returning every few days for dressing.

May 11. Wound granulating rapidly; no cartilages exposed.

May 29. Wound healed except at two points: all pain has left the back for the last two weeks.

August 1. There is a small sinus discharging very little pus in centre of last wound; general health is much improved; the cultures at this time showed the typhoid bacillus and staphylococcus aureus.

December 14, 1894. Wound perfectly healed, scar depressed, and it looks healthy; there is no pain; scar runs parallel with left costal margin, five centimetres above it; patient says wound has been completely healed since August 15; the only symptom is a feeling of numbness along costal margin corresponding to the scar.

*Bacteriological Report.*—March 22, 1894. Culture at operation, agar slant made; the pus was noted as being thick and gelatinous, and a general necrotic condition existed about the focus; twenty-four hour growth plated.

March 23. Petri plates of yesterday show large and small grayish colonies. Under low power, large colonies,—circular and oval, granular generally, with darker circumscribed centres, in the paler periphery darker spots are seen like the centre, but smaller. Cover-slips from both large and small colonies showed short bacilli with rounded ends, growing often in pairs, which stained faintly; also longer bacilli forming long threads.

Agar slant from colony, in twenty-four hours, shows uniform grayish growth along smear; after several days, fringe-like growth from edges; sour smell.

Gelatin rolls: Whitish or grayish colonies spread out on surface, and small, darker, deep colonies. The superficial colonies had dark yellowish centres, the periphery being much paler and of a gray color; the edges were uneven and wavy; no liquefaction of the gelatin.

Low power: In places a double fringe is noted at the edge; the markings in outer part are mostly parallel with border, or nearly so.

Bouillon: Clouding in upper zone,—Potato: No growth perceptible. Cover-slip showed the same organisms as the above.

Litmus milk showed faint reddening; no coagulation.

Lactose agar, 1 per cent.: No fermentation, though abundant growth along the stab.

Indol reaction: With and without nitrite, negative; parallel culture of colon positive. Hanging drop preparation showed the organisms very motile. Plated with Hg: marked double zone about Hg. The appearance of the cultures was unchanged after many days.

About one month after first operation, cultures from the sinus showed typhoid bacillus in pure cultures.

[1] Bolton, International Medical Magazine, December, 1894.

Fourteen weeks after second operation cultures from sinus showed typhoid bacillus and staphylococcus pyogenes aureus.

Conclusion : Typhoid bacillus.

CASE II.—S. M., female ; married ; aged forty-three years ; admitted to hospital April 2, 1894.

There is a definite tuberculous history. Diseases of childhood ; scarlet fever ; one miscarriage (at second month) ; pneumonia ten or twelve years ago ; patient has expectorated blood several times during last winter, at times bright red, and at times mixed with sputum ; two ounces was the largest quantity at any time.

Typhoid fever in September, 1892 ; was up and about in following November.

In January, 1893, she began to have pain in right side over lower ribs, and noticed that the soft parts over painful area were more prominent than on left side. Pain over lower ribs on coughing and on drawing a long breath ; this pain over lower ribs became less, but never entirely disappeared. Six weeks ago noticed soreness over seventh, eighth, and ninth costal cartilages on right side ; a few days later noticed that the skin was purplish in color, and that there was a hard swelling over the seat of pain. This swelling became very painful and gradually larger. Poultices have been applied, and a small projection has formed on its surface.

At present, general health good ; local condition as described above : the swelling was incised in the ward, and cultures were taken ; urine negative ; no diazo reaction.

April 6. Operation : Dr. Finney. Excision of sinus and costal cartilages of seventh and eighth ribs. The sinus leading downward and outward begins to the right of the ensiform, extending to the cartilage of the seventh rib, which is perforated. Other sinuses were formed behind this, and between it and the sixth, and between it and the eighth. These sinuses were lined by soft, reddish granulation tissue ; the perichondrium was thickened ; cartilages and sinuses were excised ; some cartilage was left in the wound ; iodoform gauze packing after irrigation with (1 to 1000) hydrarg. bichlor. solution.

April 9. Wound granulating, except over cartilages in floor of wound ; temperature 104° F.

April 18. Granulations healthy, except over exposed cartilage. Temperature 99° F. on April 12, to-day temperature is normal.

May 30. Patient was discharged. Sinus still discharging. Patient to return for dressing.

June 13. All healed except over small point of exposed cartilage. Some pain over ribs under angle of scapula.

June 23. Sinus curetted. Bacilli and micrococci found in cover-slips of discharge.

June 26. Patient was readmitted for further operation.

June 28. Operation: Dr. Bloodgood. Three cartilages found involved. They were excised as far as costal junction from sternum, at which points the periosteum was not thickened, and cartilages appeared quite normal. At all other places the periosteum was adherent and thickened, sinuses filled with granulation tissue, and the cartilage was riddled with small sinuses. Highest temperature since discharge was 102° F.

July 3. First dressing; doing well.

December 20. All healed except small area, more an excoriation than granulating area, slight dermatitis about it. Breast is pendulous and hangs over wound. There is no sinus. General condition is good. Wound has been healed about two weeks.

*Bacteriological Report.*—Cover-slips. Agar slants were made from pus obtained when mass was first incised.

Cover-slips: Bacilli varying in length from two times to several times as long as broad.

Agar slant (forty-eight hours): Whitish growth along line of smear and stab; tendency to run out from stab by sort of fringe. Growth plated.

Petri plates: Slow colonies as in Case I. Only one variety of organisms. Isolated.

Gelatin slant (forty-eight hours): Grayish-white raised colonies; glistening surface; outline wavy. Centre more opaque than periphery; colonies quite discrete; shapes vary; no liquefaction of gelatin.

Cover-slips show bacilli, mostly short with rounded ends; some straight, others slightly curved; also very long bacilli; segments not well marked.

Gelatin rolls: Seven days old. Grayish-white colonies spreading out on surface; centre more opaque than periphery; edges uneven and wavy; no liquefaction.

Low power: Central mass brownish and granular; periphery paler, gray; darker markings, mostly linear; margins uneven and wavy.

Litmus milk: Very faint reddening; no coagulation.

Potato: No visible growth (cover-slip showed organisms).

Lactose agar: No fermentation; abundant growth.

Indol reaction: With and without nitrite, negative; parallel cultures of colon, positive.

Motility: Actively motile; the field shows short, very motile bacilli; also long threads traversing the field with wavy motion.

Plate with Hg: Double ring and sterile zone; zone about seven millimetres wide.

Six weeks after first operation cultures from sinus showed typhoid bacilli and staphylococcus pyogenes aureus. Most of the primary tests were repeated for confirmation.

Conclusion: Typhoid bacillus.

Case III.—J. K. (hospital No. 10,792), male, aged thirty-six years; married; German; tailor; admitted to hospital September 5, 1894, complaining of painful swelling over right tibia, and discharging sinus over left tibial crest.

Family history unimportant. Previous history: no serious illnesses with exception of typhoid fever in October, 1893. No history of venereal infection. Habits: smokes and drinks moderately. The patient was taken ill with typhoid fever on October 4, 1893, was in bed four weeks, and for two weeks was very delirious; early in November patient was up and about. During the three weeks after rising from bed the patient experienced vague pains first in right arm and forearm for a few days, then in left leg, then over right costal margin, these were slight and soon passed off.

On November 26 there was more acute pain over *left tibial crest*, increasing in severity, and later redness and swelling. Early in December incision was made into the swelling with instant relief. About the middle of December incision was necessary in another spot above the first, and on February 1 another incision was made below the others, when a splinter of bone was removed. The sinus is still discharging. There was no pain after first operation. Patient was able to work until time of admission to hospital.

Right Leg. In November, 1893, a slight pain was noticed in the right leg over tibial crest, and a small hard nodule the size of a small nut was found. The pain was always present, but very slight. There was no history of trauma. This remained so from November, 1893, to September 1, 1894, when the nodule became red and painful, and on September 5 the patient was admitted to hospital.

At present, general condition good; thoracic and abdominal organs negative; temperature has not been higher than 99.5° F. since admission; urine negative.

Right Tibia. The middle third is occupied by a fusiform enlargement, twelve centimetres long by five centimetres wide. This area is remarkably reddened and brawny, and the skin is œdematous. Over the most prominent point fluctuation is distinct, the area of fluctuation being definitely outlined. The entire involved area is very tender; there is constant pain, more or less severe.

Left Tibia. About middle of crest is a small sinus opening, five by five millimetres, surrounded by dense inflammatory tissue. There is slight purulent discharge from sinus; probe passes two centimetres down to bone.

September 6. On the day following admission the right leg was prepared as for operation, and with all possible care the fluctuating mass was aspirated for bacteriological purposes; about ten cubic centimetres of a brownish-red fluid was withdrawn; this was of a very gelatinous consistence, and was odorless; this was plated immediately.

September 7. The condition of right tibia has almost completely subsided; redness and swelling with pain are much less marked.

Operation: Dr. Werckmeister. Right tibia shows periosteal abscess containing brownish-red gelatinous exudate. This was completely excised; bone beneath found not involved; wound packed with gauze.

Left Tibia. On stripping back periosteum from front of tibia, two new bone sinuses are found and the surface of the bone rough; this was chiselled away and further sinuses with soft bone granulations and pus were found. All the anterior part of bone was removed, and back near posterior wall a sequestrum, one centimetre by one millimetre, was found; the operation was very extensive; only the posterior wall of the bone was left; the diseased skin excised. Pure carbolic acid was applied and irrigation $\frac{1}{1000}$ $HgCl_2$; gauze packings were used; secondary sutures were passed.

September 10. Left leg doing well; secondary suture tied; right leg also doing well.

September 16. Left leg is doing well; slight sero-purulent discharge; general condition good.

*Bacteriological Report.*—September 6. Right tibia. Fluctuating mass aspirated; grayish-brown pus, very gelatinous and sticky, apparently no curds nor shreds in it; it contains some blood.

Petri plates, agar slants, and cover-slips were made at once.

Cover-slips negative; although many leucocytes and red blood-corpuscles were present.

Plates (twenty-four hours): Colonies were: superficial (I) and deep (II). Colony I: About five millimetres in diameter, slightly raised, centre small, dense, and white; periphery grayish, also rather dense, edge regular, surface glossy.

Cover-slip: Short segmenting bacillus with larger forms; agar slant made; other colonies are paler, but the organisms were apparently similar. Colony II shows same organisms as No. 1.

September 8. Colony I: Agar slant (twenty-four hours): Grayish, pearl-like growth along line of smear; a fringe-like unevenness along edge.

Gelatin stab (six days old): Free growth along stab of small white colonies; no liquefaction.

Bouillon (twenty-four hours): Slight cloudiness, granular sediment.

Litmus milk (twenty-four hours): Faint reddening, no coagulation.

Potato (twenty-four hours): No visible growth.

Lactose agar (twenty-four hours): Faint growth along stab; no fermentation.

Hanging-drop preparation showed organisms very motile as short rods; also long chains of larger organisms were seen having a wavy motion across the field.

Indol reaction ($H_2So_4$) with and without nitrite, negative.

Cultures (after ten days): Still no visible growth on potato; no fermentation; no coagulation of milk, only faint pinking; no color to agar cultures.

Conclusion: Typhoid bacillus.

Case IV.—H. H., male, aged twenty-nine years; traveller; admitted to hospital December 1, 1894, complaining of inflammatory condition over crest of right tibia. Family history negative. Personal history: *Childhood*, measles, mumps. *Adult life*, vague history of malaria. Venereal history: gonorrhœa six years ago, four and a half years, and three years ago; recovery apparently complete. Habits: alcohol in moderation; smokes but does not chew tobacco. Patient was in Ward C from October 8 to November 2 with typhoid fever; had been ailing about ten days (three days in bed) previous to admission.

*Present Illness.*—While still in bed during convalescence from typhoid fever there was pain in right foot and discharge of small amount of pus from just below right fifth toe. At the same time there was also considerable pain over right tibial crest, markedly worse from 5 to 12 P.M.

After leaving hospital pain became much less severe, almost unnoticeable. From November 8 to 24 only occasional very slight pain.

From November 24 gradual increase of pain, worse at night; no history of any trauma, but patient had been almost constantly on his feet. On November 26, a swelling appeared over crest of right tibia; no reddening of surface. There was increase of pain until November 28.

On November 29, an incision was made into the mass; no pus escaped, only blood, giving immediate relief from pain.

Patient was admitted to hospital December 2, 1894. General condition good; thoracic and abdominal organs negative. Urine, 1035, acid, sweetish odor. Chemically: phosphates; no albumen; no sugar; no diazo. Microscopically negative. Over right tibial crest is a uniform enlargement seven centimetres from above downward, in the centre of which is an opening three centimetres long, slightly gaping, the seat of former incision. There is no pain, but the part is very tender. There is no rise in temperature. Patient feels well. No bare bone is felt in wound; wound is filled with blood-clot.

December 4, 1894. Operation: Dr. Halsted. A thin layer of bone was chiselled away. Excision of diseased tissues; wound closed with silver skin stitches after thorough irrigation with hydrarg. bichlor. (1 to 1000).

December 13. First dressing; doing well; cultures taken.

December 21. Patient was discharged; wound almost healed; slight granulation along incision.

March 17, 1895. Wound entirely healed; no pain.

*Bacteriological Report.*—Operation, December 4, 1894. The pus was of grayish-yellow color, thick, but not tenacious; no odor. Granulations necrotic, surrounding tissues, especially muscle, markedly necrotic, and of translucent, hyaline appearance. Bouillon and agar slant cultures made at time of operation; also cover-slips of pus.

Cover-slips negative as regards organisms.

Three hours after the first cultures were taken Petri plates made from bouillon cultures and from pus that had been put on the agar slant.

December 7, 1894. Agar slants and plates. Discrete grayish colonies, irregular outline, pearly lustre, slightly raised.

Cover-slips: Show short. moderately thick bacilli; length, two or three times the breadth; ends rounded. also larger forms in shape of longer and somewhat thicker bacilli; no threads were seen. Agar slant made from a discrete colony. Agar slant (forty-eight hours): Shows pearly growth along smear.

Gelatin stab (three days): Free growth along stab; no liquefaction.

Inoculations upon potato (twenty-four hours) showed no visible growth. (Organisms in cover-slips.) Litmus milk (twenty-four hours): very faint pinking, no coagulation. Dunham's solution (twenty-four hours): clouding. Glucose agar (1 per cent., twenty-four hours): distinct growth along stab; no fermentation. The organism is very motile; in the field it is seen as short, single bacilli (very motile), and larger, longer forms (less motile).

Indol reaction (the culture having been in Dunham's solution), with and without nitrite, proved negative. Petri plate with Hg gives wide sterile zone and a double fine ring.

January 4, 1895. The appearance of the cultures of December 9, 1894 is still unchanged.

Conclusion: Typhoid bacillus.

Tissues removed at operation: Dr. Bloodgood. The sinus over the tibia is 3.5 centimetres by seven millimetres, removed with a margin of skin from .5 to 1 centimetre wide. The sinus leads to a cavity at the bottom of which is the thickened periosteum, beneath which there has been a formation of new periosteal bone, easily stripped from the surface of the old shaft in thin laminæ. The bone itself shows no marked pathological changes. The periosteum is thickened from three to four millimetres, is grayish in color, and opaque. The granulation tissue of the cavity is grayish and glistening, dotted with fine pin-point red spots, and does not differ from that seen in a syphilitic periostitis, but the tissue about this cavity shows marked changes not noted in syphilitic periostitis.

The aponeurosis of the muscle is thickened and more opaque in color. The muscle has lost its bright red color and is gray. One sees in this tissue beneath the skin and parallel to it alternate white and red streaks.

Case V.—Miss T., aged twenty-one years, was brought to Dr. Osler on November 23, 1894, by Dr. Bishop, complaining of general debility and a sore leg.

She has never been a strong girl, had always had poor digestion, and throughout the summer of this year was not at all well. In August she had an attack of fever, which began with headache and vomiting. She was extremely weak, and Dr. Bishop suspected typhoid fever. After persisting for a couple of weeks the fever subsided, but in ten days there was a slight return. The doctor remained uncertain about its nature, as she never had diarrhœa or any abdominal symptoms. Early in October she began to have great pain about the middle of the right tibia, and also on the front of the left forearm. Swelling soon followed in both regions, and on the leg a phlegmon developed, with much redness and swelling. This was lanced about a week ago by Dr. Bishop, and discharged a quantity of pus. The inflammation at the middle of the right arm gradually subsided.

*Present Condition.*—She is healthy looking, complexion not very good, owing to the presence of numerous pimples. The tongue is a little furred. The pulse is good, and there is no fever. The right leg is very much swollen from the ankle to the knee. In the middle of the anterior surface there is a large area of redness over which the skin is glossy, and an incision about two centimetres in length, from which a thin, sanious pus exudes. There is pitting above the ankle and a good deal of tenderness in the leg, but she is able to walk upon it.

On the left arm about the middle of the shaft of the radius there is a swelling about three by two centimetres, which projects quite prominently. The skin is not reddened and not adherent. It feels firm and is very sensitive to the touch. The patient was transferred to the care of Dr. Finney.

November 30, 1894. Operation: Dr. Finney. Left radius. Over lower end on ulnar side was a slight elevation, very painful; no redness over surface. Incision in long axis of arm, four centimetres in length, down to periosteum of radius, which was found thickened and adherent to bone beneath. This was turned back and exposed a bone of spongy consistence. This was incised; and pus of a grayish color and thick consistence was found and removed. A distinct cavity was found in the bone, containing a small sequestrum ten by two millimetres. The cavity was curetted and iodoform gauze packing inserted. The skin wound was partially closed about the packing. Cultures were taken; much pus was placed upon an agar slant.

Right Tibia. Over crest of tibia about the middle was an incised wound about three centimetres long, discharging a brownish pus, the seat of former operation. Above this the skin is much discolored and of purplish color and very thin; there is distinct fluctuation.

November 30, 1894. Operation: Dr. Finney. The old wound was excised, and the excision was extended up through fluctuating point above; a dark, brownish colored pus of viscid consistence was evacuated. The skin was much undermined, and a regular phlegmonous condition existed. Cavity and pockets were well curetted and packed with iodoform gauze, after irrigation with hydrarg. bichlor. solution (1 to 1000).

*Bacteriological Report.*—Left Radius: Osteomyelitis; with sequestrum formation.

Right Tibia: Periostitis with phlegmon above seat of lesion subcutaneously.

November 30, 1894. Petri plates and slants were made from the pus twenty hours after operation. Cover-slips made from the pus were negative.

The original agar slants show discrete colonies after twenty-four hours. From radius colony I shows colonies of irregular outline, grayish, pearly surface, slightly raised. With transmitted light there is a distinct pearly lustre; the centre is more opaque and more yellowish than the periphery. Cover-slips show short, thick bacilli with rounded ends, also larger forms. Colony II is round, with regular outline, raised surface, shiny; the difference between centre and periphery is not very marked, the latter being slightly paler and thinner. Cover-slip shows a coccus,—singly, in pairs, and in groups.

Colony I.—Agar slant (five days old): Uniform grayish film over surface (the agar is very moist). Cover-slip as above.

Gelatin stab (two days): distinct growth; no liquefaction. Potato (four days): no visible growth; organism on cover-slip. Litmus milk (four days): faint pinking; no coagulation.

Organism was found very motile. Dunham's solution (two days): faint clouding. Indol reaction: With and without nitrite, negative.

Glucose agar (two days): distinct growth along stab; no fermentation.

In some cases there was a yellowish filmy growth on potato, likely due to some peculiarity in the medium, as other cultures gave an invisible growth.

All these cultural tests were repeated later, giving the same results as above, excluding the visible growth upon potato.

Colony II.—Agar slant (five days): General growth of small pin-head colonies, now assuming a yellowish color.

Gelatin (several days): distinct growth along stab; slight liquefaction of nearly half the gelatin. Potato (seven days): distinct lemon-yellow growth. Litmus milk: faint pinking; no coagulation; no further change at end of six weeks.

Dunham's solution (seven days): slight clouding.

Glucose agar (seven days): distinct growth; no fermentation.

Right tibia: The pus was of brownish-red color, was odorless, thick, and gelatinous.

After five days the original agar slant showed discrete colonies, whitish or yellowish in color, having circular, regular outlines; surface being raised.

The cover-slip showed a small coccus, in pairs, groups, and chains of four to eight.

Agar slant (two days): Shiny, pearly growth, regular margins, slightly raised.

Gelatin stab (two days): growth along stab; slight liquefaction. Potato (one day): dry, raised, golden-yellow growth. Litmus milk (one day): no change as yet. Dunham's solution (one day): slight clouding. Glucose agar: yellowish growth along stab; no fermentation.

Twenty days later. Potato: rich golden-red growth, raised and dry. Litmus milk: decided reddening; no coagulation. Gelatin: marked liquefaction.

At the end of seven weeks. Potato: as above. Litmus milk: a solid yellowish coagulum. Gelatin stab: four-fifths of medium liquefied.

Conclusion: Staphylococcus pyogenes aureus in the right tibia; in the left radius the bacillus typhoideus and the staphylococcus pyogenes citreus.

Case VI.—Dr. (?) had typhoid fever from March 8 to April 25, 1894. During the past two months he has been at work. While still in bed he noticed a twinge of pain just above the left costal margin; it has increased and extended along the eighth rib; there is now on this rib, from mid-axilla to nipple line following the course of the rib, a definite swelling, which causes slight projection of the skin, which, however, is freely movable and uninvolved; there is no fluctuation, no special soreness, except on deep pressure.

His general condition is excellent; he looks well; tongue is clean; percussion is clear over the axillary and lower mammary regions; no pleural friction; a few small crackling, probably pleural râles on deep inspiration over mass.

It is so firm and hard, and his general condition so good, that he will wait a month to see if it will not resolve spontaneously.

Though the doctor looks well and strong, and has gained in weight and strength, he has still a little fever every day.

The case was seen on June 30, 1894; guaiacol was used locally three times a day until September 1, when patient thought he was all right; during September and October patient was well; no pain; no enlargement noticeable.

All went well until the middle of November, when the place became a little tender again; there has been gradual enlargement with pain since; the swelling is now two-thirds as large as it was in June last; the temperature shows $\frac{4}{5}$° to $1\frac{1}{5}$° F. elevation each day.

This was by note to Dr. Osler, December 14, 1894. The last report from the patient was in June, 1895, when he states that the swelling has again subsided, leaving only a painless induration in its place.

Of six cases four occurred in men and two in women. In the reported cases the condition has been more frequent in men.

The ages ranged from twenty-one to forty-three years. Age is not believed to be a factor of any importance.

In a majority of cases the character of the typhoid fever attack bears no relation to the occurrence of these lesions. It was very difficult to obtain any correct account of the attack in most of these six cases.

The period after recovery from typhoid fever at which the lesions appeared varied from one to sixteen months. In two it was one month, in one two months, in another ten months, in another sixteen months, while in the remaining case the condition has not yet gone on to necrosis, but has recurred and subsided spontaneously now for the second time.

Sir James Paget described this condition as coming on when the patient was "well of his fever" when the temperature had already become normal, and convalescence was well established. I have been unable to find, with one exception, that of Ebermaier,[1] an authentic case appearing during the course of the fever, though several have followed very early in convalescence. A large number of instances, however, of suppuration in the soft parts, either of typhoid or mixed infection, are on record, but the above case of Ebermaier's was a pure typhoid infection occurring on the thirteenth day of the fever. The latest instances range from between ten and a half and eighteen months after the subsidence of the fever.

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[1] Deutsches Archiv für klinische Medicin, 44, 1888–89, p. 141.

As to the bone involved, hardly any region of the body is exempt. The tibia is undoubtedly the bone of choice, instances in this situation greatly predominating. The humerus, radius, ulna, femur, and fibula have at one time or another been involved, whereas the feet and hands are remarkably free, a case observed by Ebermaier being the only instance I can find. In the head, the parietal and temporal bones have been affected, and in the thorax the ribs or their costal cartilages are a very common seat, probably next in frequency to the tibia. The so-called typhoid spine, supposed to be an example of the same condition in the vertebral column, is probably a neurosis. As stated above, the rarity of cases in which the hands or feet were involved is quite striking. In this connection I might say that recently a patient came to the out-door clinic of this hospital, and in giving his history spoke of an attack of typhoid fever some eight or ten years previously. On his right hand a cicatrix was noticed on the dorsal surface between the third and fourth knuckles, and on being questioned regarding it, he gave the history of an inflammatory swelling which came on during convalescence from typhoid fever (two weeks after the fever had subsided), broke down, was opened, and healed after nine weeks' treatment. Possibly this is a case in point.

In the cases here reported the lesions were in three cases in the ribs or their costal cartilages, in one case in the tibia, in one both tibiæ (only one being worked out bacteriologically), and in one the left radius and right tibia.

Usually the first symptom is pain. In three of our cases this was complained of while the patient was still in bed convalescing from his typhoid fever, in the others soon after being up and about. The pain is usually localized, but in one of these cases was widely disseminated, shifting from one region to another. It almost invariably attacks the region subsequently the seat of the necrosis. The condition has been likened to the bone pains of secondary lues. This pain usually subsides after a short time, becoming almost unappreciable, or leaving but a slight soreness over its former seat. In the painful area a slight swelling may occur, also subsiding with the pain. The duration of the swelling varies; in some cases the trouble soon recurs with pain, swelling, and indications of necrosis; in others this may be delayed for months; while again in others there may be repeated exacerbations and subsidences, never going on to necrosis.

There is, as a rule, an entire absence of fever, and the clinical course is marked by a peculiar chronicity. The symptoms at the time of necrosis are all increased; the pain becomes more severe, the surface temperature is elevated, but there are no constitutional signs. On incision the pain is relieved, but a sinus may continue to discharge for months or years.

Chantamesse and Widal speak of a case of periostitis of the tibia appearing during convalescence, which was treated by incision, the wound remaining open, and still discharging at the time of their reporting the case four years later. Sultan has observed a case of necrosis of the ribs discharging spontaneously, and persisting with sinus formation for six years.

Cases II and III are instances of what has been previously described by Chantamesse and Widal.[1] In both the initial pain appeared shortly after recovery from typhoid fever, while the patient was up and about. This pain was accompanied by some thickening of the tissues in the painful part. Within a short time both pain and induration subsided, but not entirely, and there remained in Case II a noticeable induration with more or less tenderness, but no actual pain; while in Case III a definite rounded periosteal node persisted causing no inconvenience whatever. This condition lasted for fourteen and ten months respectively, at which times, from no apparent cause, a sudden exacerbation took place, both rapidly going on to necrosis. Chantamesse and

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[1] Bull. et Mém. Soc. Méd. des Hôp. de Paris, Nov., 1893.

Widal speak of the condition appearing as a periosteal node or exostosis, or later as a periosteal abscess, which is precisely what occurred in Case III. These writers definitely separate these specific typhoid bone lesions from those due to mixed or pyogenic infection. They draw attention to the late period at which the onset follows the typhoid fever attack, to the subnormal temperature, and to the absence of septic signs, and refer to them as " suppurations frôides," likening them to the exostoses of syphilis and the cold suppurations of tuberculosis.

There is a certain proportion of cases in which necrosis does not take place. These of course cannot be subjected to bacteriological study, but they are in every other particular so similar to the foregoing that they may be placed in the same category. Sir James Paget refers to one patient who remained subject to repeated attacks of pain and swelling of the periosteum three years, yet without any sign of suppuration or abiding change of structure beyond a slight thickening. Orloff has observed the same tendency of some cases to resolve. In one series of experimental inoculations[1] with typhoid bacilli, in a few instances resolution of a definite tumor was noticed, after having existed for quite long periods of time, whereas in others the tumor broke down.

Case VI is an instance in which the node resolved. The onset was, as in the other cases, during convalescence ; later the tumor formed over the costal margin, but slowly subsided. Almost eight months "post-typhoid" it again appeared, and recently—about one year from the onset—the patient reports a second subsidence of the condition, with a painless induration remaining in the affected area.

It may be that some of the cases of " typhoid spine" described by Gibney[2] should be placed in this class. It has been considered to be a perispondylitis involving the periosteum and fibrous structures about the spinal segments. In many respects its clinical history and course are similar to that of the cases under consideration, except that the pain is so much greater, but here, as in the resolving cases elsewhere, the bacteriological proof is also wanting.

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[1] Dmochowski und Janowski, Centralb. für Bacteriologie und Parasitenkunde, Bd. XV, No. 7, 1894.

[2] Transactions of American Orthopædic Association, Sept., 1889, and Johns Hopkins Hospital Reports, Vol. IV.

A satisfactory explanation of the occurrence of bone lesions after typhoid fever has not as yet been advanced, but many valuable observations have been made.

The discovery by Quincke of the typhoid bacillus persisting in the bone-marrow after the attack presupposes a lowered vitality and susceptibility of the tissues so involved, but the setting up of a necrosis in one case and not in another is the point difficult to explain.

As to the influence of trauma allowing the presence of the typhoid bacillus in the bone-marrow and the resulting lowered vitality, trauma is doubtless in many cases an important factor. There are, however, many instances in which no such history can be obtained, and there are those showing multiple lesions, as that reported by Fürbringer, which can hardly come under this heading.

The effect of overstrain and muscular exertion, as brought out by Keen, is suggestive. He reports the case of a man who, some months after recovery from typhoid fever, returned to his occupation as rivetter in an iron works, which necessitated much standing and hammering, the strain thus falling mostly upon the right arm and leg. There shortly appeared a swelling of the right arm, and later formation of fistulous tracts through which pieces of dead bone came away. After recovery he returned to work, when a similar condition appeared in the right thigh and later in the left. The interesting point is that the lesion of the arm was at or about the deltoid insertion, and that of the right thigh at the insertion of the glutæus maximus, and that of the left at the lesser trochanter, all these being points upon which strain would fall in such acts as standing and hammering.

In the cases of typhoid spine reported by Gibney, a definite history of injury was given in two, but in many others no such history can be obtained. Of the fourteen cases reported by Chantamesse and Widal, three showed a predisposing cause in an old fracture callus. Case IV was treated in Ward C of this hospital during the attack, and while lying quietly in bed he experienced the first pains in the tibia. Subsequently he walked excessively, which may have favored the development of necrosis, but he had made no exertion, nor had there been a trauma before the first appearance of pain.

From the bacteriological notes of the cases here reported it will be seen that in four out of the five the typhoid bacillus was obtained in pure culture. The remaining case being a mixed infection, the lesion of the radius showed typhoid bacillus associated with the staphylococcus pyogenes citreus, and the tibia, the staphylococcus pyogenes aureus alone. The wound of the tibia in this case had been opened, and therefore exposed to contamination from without for about ten days previous to the time of taking cultures, but this would not, so far as we know, have resulted in causing the disappearance of the typhoid bacillus had it ever been present. The length of time that these sinuses may remain open and exposed to external contamination, and yet be proof against it, is very remarkable. In Case I, at time of admission, the sinus had been discharging for three months, yet cultures from it showed the typhoid organisms alone. In Case IV the exposure was but for a few days, yet it was free from contamination. The most striking example of this, however, is the case reported by Sultan, in which the wound remained open for six years, yet at the end of that time cultures from the open sinus showed the typhoid bacillus unassociated with any other organism. Others have noticed the persistence of the typhoid bacillus in the wound alone, or associated with other organisms, in a large number of instances. Chantamesse and Widal observed one case of six months', and another of four years' duration, and D. Buschke has reported a case of abscess of a rib showing the organisms seven years after the attack.

Cases I, II, III, and IV all showed typhoid bacillus in large numbers before operation. In Cases I and II, the lesion being situated in the chest-wall, and infiltrating deeply into it, all the diseased tissues could not be removed. After the operation the organisms were still found in the wound, which showed little tendency to heal beyond a certain point. Extensive secondary operations were accordingly performed, and yet cultures three and a half months later showed the organism in one of the cases. The necrosis again had deeply infiltrated the thoracic wall. Recovery in these cases was slow.

In Cases III and IV the lesion was situated in the tibia, and in each case an extensive operation was performed, removing all diseased and suspected tissues, both in bone and soft parts. In Case IV cultures were taken at the first dressing on the ninth day, which proved to be negative. In both of these cases recovery was rapid and uninterrupted, the patients being discharged from hospital—wounds healed—on the twenty-seventh and twenty-first days respectively.

There can be little doubt that the chronicity of the process, and the long periods that the sinuses continue to discharge, are due to the persistence of the organism in the focus. The study of these four cases, though a small number, suggests this very strongly, and points to the fact that complete removal of the diseased tissues alone may be followed by rapid and satisfactory results.

The bacteriological technique in the working out of these cases was as uniform as possible. In three of the five cases the pus was plated in agar almost immediately, and in the other cases the agar slants taken at the time of operation showed the separate colonies so discretely that they served the same purpose.

In all cases cover-slips from the pus were examined, but in one case only were the organisms found. This difficulty of staining typhoid bacilli in cover-slip appears to have been the experience of many, the explanation lying in the fact that in the first place, they stain very poorly, and in the second, that they very readily part with that stain when subjected to decolorizing agents.

The growth on nutrient agar-agar and gelatin, potato, and sugar agar, in bouillon and litmus milk, and the reaction when subjected to the test for indol, were all characteristic of the typhoid bacillus.

In Case V, in some instances a growth was seen upon potato, but subsequent implantations resulted in the usual invisible multiplication of the organism as proved by cover-slip preparations. This visible growth has frequently been met with, but does not disprove the identity of the bacillus as it is considered to arise from some peculiarity in the culture medium.

The test with metallic mercury, as described by Dr. Bolton,[1] showed the double zone characteristic of the typhoid organism in all the instances in which it was applied.

Morphologically, the organism was a short bacillus with rounded ends, freely segmenting, and forming at times long chains. In addition were larger bacilli with ends more square, seen singly, in pairs, and forming long threads. These latter forms were very constant. Nothing resembling spores was seen.

Motility was marked, especially in the smaller forms; in the larger less so. The long threads moved by slow, wavy motion across the field of the microscope.

As to the staphylococcus pyogenes citreus and aureus, conclusive descriptions of the cultural reactions obtained are given with the cases in which these organisms occurred.

In the study of these cases the bacteriological considerations are of course the more important, and the pathological considerations are usually dismissed with a few words. The character of the lesion has, however, of late given rise to much speculation with some who would seek to prove it a necrosis rather than a true abscess formation. This has been based largely upon the appearance of the pus, and the microscopical examination of the same. In an article Klemm[2] speaks of this, and definitely states that a difference exists between the lesion produced by the local typhoid infection and that of the pyogenic cocci. The exudate in the typhoid infections he describes as being rich in detritus and containing but a comparatively small number of leucocytes, and he states that it should not be called pus.

The chronicity of the process, so frequently seen, has caused it to be considered by some analogous to the cold suppurations of tuberculosis, and the necrosis of syphilis; in fact, it has been classed with the infectious granulomata. So far, however, nothing has been found in the diseased tissues which can be considered characteristic of, or peculiar to, this condition. A small cell infiltration with a greater or less leucocytic infiltration has been seen in all, the development of new tissue varying with the length of time the disease has existed. In some of the more acute, the infiltration is intense, and in one case we have observed a rather diffuse necrosis, as we thought from the gross appearances, but on microscopic examination it was found that nuclear staining was still present, though very faint. In this case (No. IV) the appearances at the time of operation were quite striking. The case was the most acute that we have seen, and came on at the shortest period after the primary disease, and was operated upon six days after necrosis was established. The focus of necrosis was quite circumscribed over the crest of the tibia, but the tissues surrounding it were of a grayish translucent appearance, strongly suggested a condition of necrosis. This, however, as before mentioned, showed faint nuclear staining.

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[1] International Medical Magazine, December, 1894.

[2] Archiv für klinische Chirurgie, Bd. XLVII.

As to the pus obtained from these cases, it is difficult to say that there was any characteristic feature. In Cases I and III the pus was of a brownish-red color, very thick, and gelatinous and odorless. In Case IV it was grayish in color, thick but not tenacious, and also odorless. Whereas in Case V (tibia), which showed the staphylococcus aureus alone, the pus was apparently identical with that of I and III, which were purely typhoid cases, in that it was of the same color and equally thick and gelatinous. Examination of the pus showed rods in Case II alone. In two of the cases there appeared to be an abundance of detritus present and a noticeably small number of pus cells, many of which showed considerable fragmentation. The gross appearance of all the cases was decidedly ragged and necrotic, though the same must also be said of the tibia in Case V, which was a purely aureus infection.

The *diagnosis* of these cases would rest largely upon the history of a previous typhoid fever, or perhaps some indefinite continuous fever. In Case V the diagnosis of typhoid fever was made only by the examination of the pus from the radius some weeks after the febrile attack had subsided. The occurrence during or after convalescence is suggestive of the purely typhoid cases, particularly in bone, whereas the mixed infections in bone and soft parts, and the typhoid infections in the soft parts are seen more frequently during the course of the disease.

The *prognosis* is good, as a rule, although in the article just referred to, Klemm reports a fatal case of disease of the femur showing typhoid and colon bacilli associated.

Complete excision of all diseased and suspected tissues appears to be the most satisfactory treatment. In the earlier writings this point was brought out, and mere incision was denounced as being insufficient. The persistence of the organism in the wound for such long periods of time, as some cases show, and the satisfactory results obtained after thorough and complete removal of the focus, suggest very strongly the lines along which to work.

# AN IMPROVEMENT IN THE TECHNIQUE OF CATHETERIZATION OF THE URETER IN THE FEMALE.[1]

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WHILE much advance was made in the difficult matter of ureteral catheterization by Pawlik, Simon, and others, who used the tactile method, there can be no doubt that to Dr. H. A. Kelly belongs the credit of a practical suggestion which made the procedure feasible in nearly all cases. This suggestion consisted in the elevation of the pelvis, thus causing distention of the bladder with air, when a catheter or speculum was in the urethra to allow its entrance. The gravitation upward of the pelvic contents raises the base of the bladder and so disposes the trigone and the region of the ureteral orifices that these can be seen by direct light from a head-mirror through a simple tubular speculum open at both ends. Suitable dilatation of the urethra is premised.

While this sounds simple in statement, considerable practice and not a little dexterity are required before the operation of introducing a catheter into the ureter can be accomplished. The mere recognition of the orifice, for example, is by no means easy when the neck of the bladder is covered by easily-bleeding and exquisitely-tender granulations, as in two of my cases. Many tiny depressions between granulations greatly resemble it.

The location of the orifice with relation to the urethra also varies, though ordinarily it may be found by directing the speculum at an angle of thirty degrees from the long axis of the body. In my hands, however, especially in cases where pelvic inflammation interferes with the mobility of the pelvic contents and a favorable disposition of the bladder wall, the chief difficulty and annoyance consists in the rapid filling up of the field of search by a few drops of frequently turbid urine as it escapes from the ureters, and, under some conditions, the formation of large bubbles in the speculum caused by respiratory or other movements of the patient. This is of the more importance as a prolonged search for the orifices is not infrequently necessary. Dr. Kelly[1] reported recently a case where, owing to disease of the base of the bladder, he had many discouraging failures before succeeding. In order to keep the field dry during this search, Dr. Kelly uses a long, soft rubber tube, with a suction bulb on the end. This is put through the speculum from time to time and the major portion of the urine withdrawn, while the field is afterwards dried by mopping with little balls of cotton held in forceps. These manipulations result not only in discontinuance of the search, but often, from movements of the patient, of the speculum, of the artificial light or the mirror, the field is lost, perchance, at the moment of success.

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[1] Read before the Surgical Section of the College of Physicians of Philadelphia, April 12, 1895.

One of my patients flinches in spite of cocaine and moves the whole body every time the cotton touches the inflamed bladder wall, causing most annoying loss of field and refilling the speculum with urine. It was to remedy this difficulty of constant interruption that the appliance here shown was devised. It is intended to supplement Dr. Kelly's method and make it more easy of application. It consists essentially of an apparatus which will cause suction of air constantly through a fine tube, which extends to the internal opening of the speculum,—that is, to the field of work. There are necessary a hand air-pump, a bottle with perforated cork through which two tubes pass. Two pieces of light rubber tubing, one connecting the pump with the air-bottle, the other connecting the air-bottle with the tube (or catheter) extending to the field of work. The apparatus is not unlike the ordinary surgical aspirator with all valves open.

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[1] Johns Hopkins Bulletin, February, 1895.

To the suction tube is attached, in one arrangement (Fig. 1), the end of a ureteral catheter constructed with a single opening, and that at the point and not at the side. If now the air-pump be kept constantly and gently at work while search is being made with this catheter through the speculum, any urine which may appear in the field is at once whipped off by suction through the ureteral catheter to the bottle, and the field will thus be kept dry indefinitely. It is not intended that a decided vacuum be established, but that the pump be kept going constantly and gently, the bottle, which should hold a quart at least, serving only as an air-chamber to equalize suction between strokes, and as a reservoir for waste urine. As soon as the ureter is entered, the suction-tube is to be slipped off the catheter and the specimen collected in the ordinary way. Any ureteral catheter may be used which has a single eye at the point, but preferably there should be no enlargement to serve as a handle, as this interferes with vision. A slight curve at the outer end is all that is necessary for the delicate grasp required.

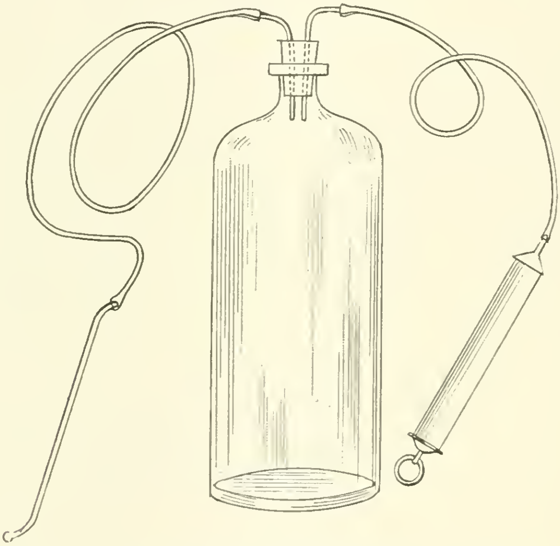

FIG. 1.—Suction apparatus attached to ureteral catheter for removing urine from speculum.

While the above described arrangement is more satisfactory, the same principle may be applied in another way.

A firm of this city has made for the writer a speculum, through the interior of which runs a fine suction-tube rigidly attached at the side. To this inner tube the suction apparatus is attached. This arrangement leaves one hand of the operator entirely free to use a searcher or other instrument. The obturator is suitably grooved at the side to allow for the presence of the suction-tube.

The handle of this speculum is modified by being fenestrated and directed upward at an angle of thirty degrees, so as to keep clear of the patient's body when turned to one side, and in order that the direction of the speculum itself may be more readily kept in mind (Fig. 2).

In catheterization of the ureter, and especially in passing a flexible instrument to the kidney for the detection of obstructions or the draining of collections, it is of very great importance that traumatism be avoided.

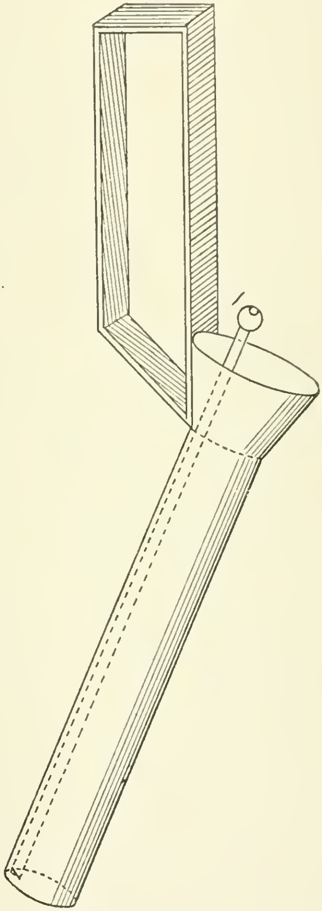

Fig. 2.—Urethral speculum with inner tube for draining urine (full size).

It is sufficient to use cocaine for all ordinary cases, and if dilatation is not carried beyond ten millimetres, nothing more than a temporary frequency of urination or slight pain will be encountered, providing everything is aseptic. Lubricating oils should be replaced by boroglyceride, and the patient should lie down for a few hours afterwards, unless accustomed to the operation. When using a catheter of small calibre with eye in the end, it is sometimes observed that some of the urine escapes by the side of the catheter, a fact to be borne in mind in estimating the relative secretion of the two kidneys. It is safer to wash out the bladder with boric acid solution before and after the manipulations, while particular care should be taken that the mouth of the urethra and surrounding parts are made clean before beginning.

Cases are not numerous where the use of the ureteral catheter is necessary, but its field is important and likely to increase. Certainly, all cases should submit to this examination prior to a nephrectomy. The writer has now under observation a hydronephrosis from obstruction in the ureter, due to old pyosalpinx which was removed. Serious danger has threatened from rupture of the hydronephrosis. Catheterization has shown that nephrectomy is forbidden by the condition of the other kidney. The diseased ureter has now become pervious, however, the stricture is under course of dilatation, and the sac is being well drained, with great relief to the patient.

# REPORT OF A CASE OF IMPACTED URETHRAL CALCULUS.[1]

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THE case herewith reported is of interest to the profession from its rarity; a stone originating in the urethra being a very unusual occurrence. It is believed that the alkaline are the only variety which form in that region; their usual location is directly behind tight strictures, in cavities left by abscesses, or in follicles with dilated mouths.

Referring to the literature of the subject, I find that Block removed a stone from the urethra of a patient which had been carried in that position for twenty-eight years. Keys reports a case in which he found five phosphatic calculi. Pulido removed a stone from the scrotum of an individual which weighed twenty-three ounces. A urethral stone removed by Rotelot weighed sixty grammes. Similar cases, the calculi, however, being of smaller dimensions, are reported by Graefe, Ulecia, Civiale, Voillemier, Camper, Maigret, Heath, and Boutelle. Dr. John H. Brinton states that on one occasion, while performing a perineal section for the relief of a stricture of the urethra, he encountered a large-sized stone in the perineum. While making a post-mortem examination, Dr. W. L. M. Coplin also came across a stone in the perineum, the existence of which had not been suspected before death.

The history of the case that I have to present is briefly as follows:

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[1] Read before the Surgical Section of the College of Physicians of Philadelphia, April 12, 1895.

The man was a laborer, forty-five years of age; admitted to the Jefferson Hospital on October 17, 1894. He complained of great difficulty in passing water; all the urine coming through a fistulous opening in the scrotum; none passing through the urethra. He was subject to frequent attacks of retention of urine, which were relieved by placing himself in different positions, such as assuming the knee-chest, or by lying on his side or back. He was anæmic, much emaciated, and had the appearance of one exhausted by prolonged suffering.

He stated that six years previously he had fallen from a ladder, striking his perineum by coming in contact with a projecting beam. At the time he experienced a dull, sickening pain in the region of the perineum; the parts becoming swollen and tender. Shortly afterwards he found it was impossible to pass his water, whilst at the same time blood was slowly oozing from the meatus. He was put to bed, a catheter was passed, and the water drawn off. The instrument was retained in place for several days. Two or three months after this he began to be troubled with a frequent desire to micturate, accompanied by great difficulty in starting the stream; these symptoms gradually increased in severity until finally it was with the most difficulty that the contents of the bladder could be evacuated. An abscess formed at the peno-scrotal junction, which was lanced; after which the urine passed both by the urethra and by means of a fistulous tract which had resulted from the abscess.

As time went on the amount of urine passed through the urethra grew gradually less in quantity, until, finally, within a few months previous to his admission to the hospital, the entire contents of the bladder were voided through the fistula.

When first seen, the skin in the region of the scrotum and thighs was inflamed and excoriated; the result of being constantly bathed in urine. A fistulous opening existed below the left testicle, an inch to one side of the medium raphé. The perineum was thickened and distended, and was occupied by a nodular mass about the size of a lemon. A full-sized instrument was readily inserted as far as the bulbous portion of the urethra; beyond this point not even a filiform could be made to pass.

On examining the fistulous opening it was found blocked by a gritty substance, which, on being removed by means of a small ear-scoop, proved to be bits of phosphatic calculi. The patient stated that he frequently passed small pieces of stone through the opening. A flexible probe was inserted into the canal, which was arrested by encountering a large stone seemingly located in the membranous portion of the urethra. The patient was suffering from retention of urine at the time ; the bladder being distended far above the pubis. After gently tapping the part and sounding with a probe, in order to get an idea of the size and density of the stone, the urine began to flow freely through the opening, carrying with it fragments of calcareous matter.

The urine was alkaline, very offensive, ammoniacal, and loaded with pus and phosphates. A chemical examination showed that it contained albumen. The microscope revealed the presence of blood and pus-corpuscles. The amount of urea was far below normal. The urine constantly dribbled through the fistulous opening, so that the amount that passed in the twenty-four hours could not be collected, and hence could not be determined. The length of time from which the patient had suffered from urethral obstruction, his broken-down constitution, and the condition of the urine, led to the surmise that the case was complicated with chronic inflammation of the bladder and surgical kidneys.

Under the circumstances it was determined to give the patient rest, and attempt to improve his general condition by means of good food, stimulation, tonics, and the administration of such remedies as would have a tendency to antiseptize the urine.

After two weeks' treatment, during which time he suffered from repeated attacks of retention of urine, it was decided that medical treatment had done all that could be hoped for, and that any further improvement could only be effected by removing the stone which obstructed the passage of water.

Taking his general condition into consideration, it was thought inexpedient to do more than remove the stone, and by this means drain the bladder ; for it was naturally inferred that the stricture was in front of the calculus, and that when this impediment was removed that the attacks of retention would cease. Should he recover from the first operation, and his general health improve, an operation on the stricture would be performed.

After being placed under the influence of chloroform he was brought before the class and put in the lithotomy position. An incision was made extending from the fistulous opening in the scrotum along the perineum almost up to the sphincter ani. While making the cut an abscess was opened, which discharged a large quantity of most offensive pus.

The stone was found to occupy the membranous portion of the urethra extending as far forward as the bulb, filling up the lower portion of the scrotum. Although movable, it seemed to be attached in certain portions. It was found impossible to draw it through the wound ; it was broken into several fragments, which were readily evacuated by the means of a lithotomy scoop.

The urethra behind the stone was found to be patulous. The canal in front of the stone was completely closed and no instrument could be passed through it into the perineal wound. The parts were irrigated with mercuric chloride solution, a rubber drainage-tube inserted, and then dressed with antiseptic iodoform gauze.

For the first ten days after the operation the patient's general condition rapidly improved ; after that he began to suffer from irregular chills, followed by slight fever. The tongue became red and glazed ; there was nausea and vomiting, which was followed by an uncontrollable diarrhœa. This condition was attended with suppression of urine, delirium, and coma ; and finally ending in death.

A post-mortem examination was made eighteen hours after death. The body was emaciated ; the rigor mortis was unusually well-marked. The lungs, heart, and abdominal viscera were normal, with the exception of the kidneys. That of the left side was simply a large sac filled with pus ; whilst that on the right side was much enlarged and contained distributed through it numerous small abscesses. Both ureters were enormously thickened ; especially the left, which measured forty-one millimetres in circumference. The bladder was chronically inflamed, atonied, and sacculated. The mucous membrane was covered with gelatinized pus, and in places had undergone superficial ulceration. The prostate gland contained a large abscess. The cavity which had contained the stone was lined with healthy granulations. The urethra from this point back to the bladder was free from obstruction ; but at the seat of stricture, which was at the bulbous portion of the canal, it was completely obliterated.

It is interesting to study the presumed different pathological changes which must have taken place from the period when the stricture began to form up to the time of the patient's death. As the stricture tightened the urethra back of the obstruction, no doubt, slowly dilated until it assumed the form of a pouch which contained urine, which was continually undergoing more or less decomposition. At the same time the mucous membrane lining this portion of the canal must have become inflamed, and then ulceration gradually taking place allowed the urine to infiltrate into the submucous tissue, which eventually gave rise to an abscess followed by a urethral fistula. In the mean time the calibre of the urethra at the seat of the stricture was becoming smaller and smaller, whilst there was a constant effort on the part of the bladder to force the urine through the ever contracting normal channel and through the new outlet. As the disease progressed the walls of the fistulous opening became indurated, making it more difficult for the bladder to expel its contents; and there must have always been more or less residual urine in that viscus, gradually giving rise to cystitis, followed in turn by inflammation of the ureters and the kidneys. The alkaline ammoniacal urine coming from the inflamed bladder, loaded with phosphates and gelatinized pus, settling in the urethral pouch back of the stricture, naturally precipitated the triple phosphates with other alkaline salts, which becoming agglutinized formed the nucleus of the stone.

Once started it daily increased in size by fresh deposits from the alkaline urine with which it was constantly bathed. In the mean time the urethral canal in front of the stone became completely obliterated.

From the knowledge gained from the post-mortem examination as to the exact condition of the kidneys it is probably fortunate that chloroform was the anæsthetic administered; for if ether had been employed it is very possible that death would have followed from suppression of urine almost immediately after the operation.

It seems therefore to have been wise to have attempted only to relieve the obstruction to the passage of the urine by removing the stone. For if an effort had been made to remove the stricture the operation would necessarily have been greatly prolonged; the additional shock and the length of time required to keep the patient under the influence of the anæsthetic might have resulted in death. It is doubtful if complete obliteration of the urethra is ever met with except in traumatic stricture. Nineteen cases of complete obstruction of the canal have been reported by Tadriate; of these fifteen were located at the bulb, one at the suspensory ligament, two in the penile portion, and one three inches behind the meatus, and one followed injuries produced by bullet wound.

# THE OPERATIVE TREATMENT OF FRACTURE OF THE PATELLA.[1]

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THE important questions to be considered in regard to the treatment of fracture of the patella are as follows:

(1) Are the results obtained by the ordinary methods of treatment satisfactory?

(2) If not, what are the causes of failure?

(3) Is there no method less radical than that of opening the joint and wiring the fragments which will be equally effective?

As to the results obtained by the use of splints, plaster dressings, etc., every surgeon is familiar with the disability accompanying ligamentous union in cases of transverse fracture of the patella, and it is safe to say that bony union is one of the rarest occurrences after such an injury. The patient, with a fibrous band of an inch or more in length interposed between the upper and lower segments of his patella, will have a gait which is peculiar and unmistakable. He cannot bring forward the foot without flexing the knee; he cannot go down-stairs without placing both feet on the same step at the same time, on account of his inability to maintain the leg of the injured side with any certainty in the line of the thigh. If he is in the supine position he cannot lift the limb while holding the leg in full extension. In addition, there is a feeling of uncertainty in standing and walking, frequent and recurrent hydrops articuli, atrophy of the quadriceps femoris, often more or less joint-pain, in many cases the necessity for a brace or knee-cap, and other minor inconveniences. Refracture is not uncommon, and in the very best cases convalescence is tedious and protracted. These conditions are not exaggerated. While Malgaigne states that he has never seen the function of the limb completely restored even when the separation was limited to one-third of an inch, Dennis asserts that, after a careful analysis of a large number of cases treated by the older methods, he has found that a separation of the fragments amounting to half an inch is considered a most favorable result.

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[1] Read before the Surgical Section of the College of Physicians of Philadelphia, April 12, 1895.

It is evident, without further argument, that, as compared with this condition, a close bony union of the fragments is greatly to be desired. Mr. Henry Morris has, to be sure, called attention to the fact that in cases where the fibrous band is very short and firm there is practically no weakening of the joint, and that in such cases, when refracture occurs, it is the bone and not the ligamentous band that breaks. Even admitting these statements as correct, I am convinced, after an independent investigation on the subject, that such results as Mr. Morris describes are extremely rare, and cannot be confidently expected in more than 5 per cent. of ordinary cases.

The alleged causes of failure to procure better results by ordinary methods may be divided into three classes.

(*a*) Lister believed that non-union was usually due to two factors: the separation of the fragments by the contraction of the quadriceps muscle, and the presence of accumulated fluid within the joint. (*b*) Von Bergmann thinks that the atrophy of the quadriceps, due to the pressure of the dressings employed and to disuse, is progressive, and believes that this condition is responsible for a large proportion of the cases in which it is impossible to extend the limb. (*c*) Macewen believes that the chief cause of non-osseous union is the interposition of fibrous and aponeurotic structures between the fractured surfaces, and that, before such union can be obtained, it is requisite in the first instance to elevate all the tissues which lie over the fractured surfaces and which prevent them from coming into intimate contact. In explanation of this view he details cases in which he has found portions of the soft parts lying between the fragments, either forced there by the vulnerating body in cases of direct injury, or driven in by atmospheric pressure when the fracture is the result of muscular violence. In such cases the fibrous and aponeurotic structures being more elastic than bone, the latter breaks first and then contracts, while the soft parts stretch, give way, and are then forced in between the fragments by the pressure of the outside air. Macewen's observations have been corroborated by Hardy, Laylard, and others. Fowler, of New York, reported a case in which he found irregular, shreddy fibres of the soft tissues at the upper edge of the rent intimately adherent to the projecting spiculæ of the roughened fractured surface of the upper fragment. Sir Joseph Lister has recently told me that, in his own cases of fractured patella, he had frequently found it necessary to elevate such portions of the soft tissues from between the fragments, and he expressed a general acquiescence in the view which attributes to them the chief importance in the production of ununited fracture.

It is safe to say that the above-named causes include all the chief factors which tend to produce non-union ; but much depends upon the relative importance which is assigned to them. It is self-evident that continued separation of the fragments must prevent union by bone. It is almost equally probable that a large unabsorbed or organized effusion of bloody synovia will have the same effect. Atrophy of the quadriceps will, of course, and necessarily, interfere with the further use of the limb, and would serve to increase the disability apparently due to the want of bony union. As to the influence of fragments of soft parts interposed between the bones, while it might seem, on *a priori* grounds, to be the least potent factor of the three, as absorption and disappearance of soft and living tissues under such circumstances might reasonably be expected, the clinical facts appear to demonstrate that it is the real cause of non-union in most cases.

I used to think that if Macewen's explanation were the correct one, and the interposition of the prepatellar fibrous structures were the chief causes of non-union, the only rational method of procuring bony union was by cutting down and elevating these fragments of the soft parts. The other indications could be met by much simpler and safer methods of treatment. The exudation in the joint can be removed by aspiration. The fragments can be brought together and held in position by bandages, or by Malgaigne's hooks, as in a case I operated on in 1888. Indeed, immediate aspiration of the joint and the aseptic application of Malgaigne's hooks covered by sterilized or aseptic dressings, together with the use of a posterior splint and a light, moderately firm bandage, would seem to meet every indication except the one which has been mentioned. The use of the hooks enables us to dispense with the excessive pressure by bandages or otherwise required to keep the fragments in apposition. It certainly approximates them more nearly and accurately than does any other method I have ever seen, with the exception of wiring or suturing. It combines all the advantages of the old methods by splints and plaster with a greater degree of accuracy in bringing and holding the fragments together. There should be scarcely more risk of septic infection than in an ordinarily subcutaneous tenotomy, provided care as to aseptic precautions be taken at the time the hooks are introduced. If Macewen had been mistaken in assigning to the influence of the presence of the prepatellar structures the majority of cases of non-union, the aseptic use of Malgaigne's hooks would in my judgment be the most rational method of treating transverse fracture of the patella. But in 1891, Mr. Barker, of London, described an operation which I soon after adopted and have since employed in a considerable number of cases. I have not invariably succeeded in getting bony union, but have done so in the great majority of the cases, and have never had any extensive separation of the fragments. My average results as to shortening the time of treatment and as to the functional usefulness of the joint later have been far superior to any I had obtained before adopting this method. The patients have never had the least after-trouble, and in no case has there been suppuration, or fever, or even marked pain. It is only fair to say that I know of cases in other hands in which septic arthritis has followed the same operation, and the patients barely escaped with their lives.

It must, of course, be admitted that this is among the possibilities, but it ought to be avoidable, and I have thus far found it so. The operation is easy and simple, and can be done in a very few minutes. The lower fragment of the patella is steadied by the finger and thumb, and a narrow-bladed knife thrust into the joint, edge upward, in the middle line of the ligamentum patellæ at its attachment to the lower fragment. Through the wound thus made a stout-handled pedicle-needle is thrust into the joint behind the lower fragment, and pushed up behind the upper fragment and through the quadriceps tendon in the middle line as close to the border of the bone as possible, the upper fragment at this time being forced down and steadied. When the point of the needle becomes apparent beneath the skin, the latter is drawn upward and an incision made upon the needle, the eye of which is then threaded with sterilized silk and the needle withdrawn, carrying the thread behind the fragments. The needle is next unthreaded and passed through the same skin wound below and out of the upper wound, but this time in front of and close to both fragments. Here it is threaded with the upper end of the suture and withdrawn. The two fragments are then brought together, friction is made to displace clots or other foreign material, and the ligature tied tightly over the lower border of the patella. The two ends of the ligature are cut short and the wound closed. A posterior splint and figure-of-eight bandage are applied. Passive motion may be begun on the tenth day. The patient may get out of bed wearing a light plaster bandage at the end of third week. Good use of the joint may be expected in from eight to ten weeks or earlier.

In estimating the comparative value of the different methods, it is needless to say that the danger to life should exert a predominant influence. This danger is undoubtedly greater by the method of wiring than by any other plan of treatment, And it is this fact which causes careful surgeons to hesitate to-day in recommending its employment. Of the 186 cases included in a table compiled by Dennis a few years ago, there were 34 cases of suppuration, 4 amputations, 24 cases in which the result was said to be "poor" (14 of them were said to have resulted in complete anchylosis), and there were eleven cases which terminated fatally. Of the remainder, 35 were marked as ending with a "fair" result, 17 of them having incomplete or partial anchylosis. Lister himself has told us that before he made the incision in the first case of wiring which he ever performed, he remarked to those sitting around him in the amphitheatre that he considered no man justified in performing such on operation unless he could say with a clear conscience that he considered himself morally certain of avoiding the entrance of any septic mischief into the wound.

The opposition at this time (November, 1883) was very strong, and such surgeons as Mr. Bryant, Mr. Adams, Mr. Sydney Jones, Mr. Henry Morris, Mr. Edmund Owen, and Mr. Grant placed themselves on record as opposed to the operation, believing that the bulk of simple fractures do well enough without it, Mr. Christopher Heath going so far as to remark that he thought Mr. Lister's paper would cost many knees and many lives. As recently as August, 1887, we find that Messrs. Barker, Thompson, Stoker, and Robson were equally opposed to the indiscriminate performance of the operation. The strength of the feeling against the operation, only a few years ago, is well shown by the following conclusions reached editorially by the London *Lancet*, after a full consideration on the subject. They were:

(1) That the operation is not suitable as a primary measure.

(2) That in view of all its dangers and of the good results obtained by other and perfectly safe methods of treatment, it is not commendable for general employment.

(3) It is not justifiable unless with most absolute asepsis.

The French Academy of Surgery pronounced against it with almost equal force, and the most recent writers on fractures and dislocations have freely agreed with Pick, who says that he would not permit the operation to be done upon himself, and therefore cannot recommend it to his patients.

Mr. Howard Marsh[1] says that the prevailing opinion in regard to this operation is that in cases of recent fracture it is uncalled for, while in many cases of old fracture it is impossible to carry it out in a satisfactory manner. He adds that he cannot recommend Malgaigne's hooks, as their use has been followed by diffuse inflammation around the patella, and even by suppuration of the knee-joint, ending in some cases fatally, in others in anchylosis, and because, although they draw the fragments more closely together than any other method except wiring, they do not by any means insure bony union. It is obvious that a few years ago at least some other method than open incision and wiring was needed to satisfy the majority of the profession, who preferred the imperfect results obtained by splints and bandages to the risks of operation. I believe that with proper care the procedure I have described—Barker's operation—meets the indications, and with a reasonable degree of safety gives far better results. Other methods have been devised to reach the same end.

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[1] "Fracture of the Patella," Heath's Dictionary of Practical Surgery.

Fowler[1] has recently reviewed this subject in a paper read before the New York Surgical Society, and proposed an operation which differs in some of its details from the other procedures described. In his preliminary remarks he makes a distinction between the fractures occurring as a result of muscular action, in which the fibrous structures in front of the joint are driven by atmospheric pressure between the fragments (as Macewen long ago demonstrated), and fracture occurring as a result of direct violence, in which he apparently does not believe that this interposition of the aponeurotic tissues occurs.

In the latter cases he does not advise operation, and seems to expect bony union. I do not believe either that the difference between the two conditions is so frequent as to offer a reliable basis for different plans of treatment, or that bony union is likely to follow in the majority of such cases.

In the former class—fracture from muscular action—he recommends a delay of two or three weeks to permit of the subsidence of the effects of the traumatism upon the surrounding structures, as well as the closure of a possible rupture of the upper recess of the capsule, which according to Riedel is frequently opened and permits of infection of the soft parts of the front of the thigh. He then by a U-shaped flap exposes the line of fracture, dissects out the intervening fibrous tissue, fastens the bone with fixation hooks and closes the wound. The hooks are allowed to remain about three weeks. He claims for this method the following advantages :

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[1] ANNALS OF SURGERY, June, 1895.

(1) The parts to be operated upon are in better condition, both as regards vital resistance and asepsis than when the primary operation is done.

(2) There is the minimal exposure of the joint surfaces and disturbance of the fragments.

(3) The operation can be done in a remarkably short space of time, hence less risk is taken both as to sepsis and the anæsthetic.

(4) No foreign suture material is left in the bone to produce caries, or to demand subsequent reopening of the wound and removal.

(5) The hooks may be removed, and if the union is not found to be complete or firm, they may be reapplied.

If my experience with Barker's method had been either less extensive or less satisfactory I would be disposed to consider this, but I can see no present reason for doing so.

In the discussion which followed the reading of Dr. Fowler's paper, Dr. Stimson, Dr. Bryant, Dr. Abbe, and Dr. Lilienthal expressed in a general way disapproval of operative treatment except in the hands of hospital surgeons of large experience, and the last three a preference for the non-operative methods in most cases.

Ceci[1] describes a method consisting of a subcutaneous buried suture which surrounds the patella, and passes through the tendons above and below it close to its margin. He believes that this plan of treatment has the following advantages : The general applicability of the suture, no matter how great the comminution of the patella ; the mechanical union of the fragments, independent of new bone-formation, and affording sufficient and permanent resistance to the disjunctive forces ; the subcutaneous character of the entire operation, permitting of rapid and thorough repair of the superficial and deep soft parts, completed in his cases in from four to eight days; the removal of the splints as early as the end of the first week, after which the joint requires neither immobilization nor compression. The practical advantages of the method he thinks may also be seen when it is studied in its relation to the causes of non-union. If, for example, union does not take place, on account of blood or synovial exudation, puncture of the joint or aspiration is not required, as the exudation will escape through the openings made to admit the suture, and this emptying the joint can be facilitated by the employment of gentle massage. Atrophy of the quadriceps is to a great extent avoided, by the very early period at which passive motion or even active movement can be permitted. If union is prevented by the interposition of fibrous bands, the subcutaneous wire suture is sufficiently strong to hold the fragments together.

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[1] Deutsche Zeitschrift für Chirurgie, February, 1888.

In several of his cases, months afterwards, the wires could be felt plainly through the skin and gave rise to no trouble or inconvenience of any sort. The operation appears to bear a close resemblance to that of Volkmann, who employed a silk suture passing out through the quadriceps tendon and through the tendo-patellæ; and to that of Kocher, who passed a silk thread above and below the fragments by means of a transverse or longitudinal incision. König has done a similar operation, employing catgut. Stimson has also employed a particular suture after the manner of Ceci.

But all of these methods are, in my opinion, theoretically inferior to that of Barker, which for ease and celerity of performance, and thoroughly satisfactory results, is, I believe, to-day the operation of choice. I present three patients this evening, one operated on eighteen months ago for Dr. Taylor, of Beverly, one eleven months ago for Dr. Gerhard, of Bryn Mawr, and one eleven weeks ago at the University Hospital in the presence of the class. They all have either absolute bony union or such close fibrous union that no motion between the fragments can be demonstrated. There is often much difference of opinion between surgeons as to the presence or absence of very slight degrees of mobility. But, although I think that in each of these cases firm bony union is demonstrable, it is after all a matter of secondary importance. They all have the most complete use of the joint. The two oldest have tested it in their daily work in every imaginable way. If the union is fibrous, it has not lengthened the smallest fraction of an inch in all this time, and whether it is or not becomes a question of pathological interest, but scarcely important from the stand-point of practical surgery.

# THREE CASES OF WIRING OF THE PATELLA FOR OLD FRACTURE WITH DIVISION OF THE QUADRICEPS MUSCLE, AND CHISELLING LOOSE THE TUBERCLE OF THE TIBIA IN TWO OF THE CASES.[1]

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CASE I.—H. K., aged thirty years; weight, 240 pounds; six feet two inches high. First consulted me at the Jefferson College Hospital, February 14, 1894, at the instance of Dr. T. H. White, of Connellsville, Pa. Dr. White gave me the following history: that the patient was the superintendent of a lumber establishment, and on October 9, 1892, fractured his right patella by a fall. Dr. White treated him by means of adhesive strips, and a posterior splint with a very satisfactory result, there being merely a narrow seam between the two fragments. On February 14, 1893, he slipped on a wet board and fell with his whole weight on the injured knee in a flexed position, rupturing the ligamentous union which had been secured. He returned to Dr. White, who treated him with a full length leather splint, in which tongues were cut above and below the knee to receive the adhesive strips and bandages used in bringing the fragments together. This was worn for several weeks after leaving the hospital. The space between the fragments was about one-half inch. May 24, 1893, he again fell, stretching the union still farther. He was treated as before, and when discharged the separation of the fragments had increased to one and a half inches. On December 27, 1893, he fell for the fourth time and still farther separated the fragments, which now amount to three and a half inches in extension and five inches in flexion. Even with this wide separation he has fair use of the leg when he is walking on an even surface, but over rough ground or over logs, as he is compelled to walk over by his occupation, the leg is unstable.

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[1] Read before the Surgical Section of the College of Physicians of Philadelphia.

Operation, February 19, 1894. A vertical incision was made in the axis of the limb, which was finally extended to about twelve inches, for reasons which will appear later. The knee-joint was opened, and cultures made from the fluid in the interior, the result being negative. It was found filled with synovial fluid, mixed with the remains of blood-clots. The anterior surface of the femur was very red, presumably, however, rather from staining of the blood than from inflammation. The two fragments of the patella were separated three and a half inches, the upper fragment (about three-fourths of the whole bone) being an inch in thickness antero-posteriorly. The lower fragment was split off from the upper obliquely, from above downward and backward, making its upper edge, or that which presented towards the other fragment, but little over a quarter of an inch in thickness.

After sawing off the fractured surfaces, by which about half of the lower fragment was removed, the two fragments were drilled and an attempt made to join them by means of silver wire (diameter No. 3, French catheter scale), but the fragments could only be brought to a distance of two and a half inches. Therefore, having prolonged the incision, as before stated, upward, I divided the tendon of the rectus about two and a half inches above the patella completely down to the bone, together with two incisions from the end of this transverse one, respectively outward and inward thus /‾‾\. When this division was effected, I was able to get the two fragments within about an inch and a half of each other, but by no possibility would traction effect their approximation any further. Accordingly I chiselled away the tubercle of the tibia, together with a considerable portion of the thickness of the bone in a V-shaped fragment. This loosened the lower piece so that I could just get the fragments to touch when the leg was in extension. Each fragment of the patella was held chiefly by lateral fibrous attachments. The lower end of the piece chiselled from the tibia tilted so much upward when traction was made that I wired transversely through the edges of the tibia, passing the wire in front of the lower end of the fragment, in which I sawed a slight groove in order to hold the wire. The ends of both wires were cut off and gently hammered into the bone. The soft parts on the outer border of the two fragments of the patella were drawn together, where they gaped considerably, by means of a double silkworm-gut suture, which was buried. All the soft parts that were incised bled profusely, a number of small arteries close to the bone spurting freely. They were controlled, however, by hot water and pressure and hæmostatic forceps without any ligatures. The incision was now sutured and the leg placed on a Macewen splint.

On February 20, the day after the operation, an incision was made at the inner and lower part of the wound and a drainage-tube inserted. On the 22d the drainage-tube was removed, the wound being in excellent condition.

He made an uninterrupted recovery, and was discharged in eight weeks, walking with a cane. After five weeks, active and passive movements were begun.

April, 1895. After fifteen months the result is excellent, flexion to ninety degrees being easily attained. The fragments are slightly movable on each other. The wire has never given any trouble.

Case II.—Mrs. M. E., Glencarbon, Pa., aged forty-three years, was admitted to the Jefferson College Hospital March 3, 1894. In August, 1893, she fell while descending a flight of steps and hurt her knee. It was not seen by a physician until the following day, when the swelling was so great that he could not tell what was the trouble; when the swelling finally subsided a fracture of the patella was discovered, but the fragments were so far separated that union was impossible. She is in good health, bowels constipated, urine acid, cloudy, sp. gr. 1020, neither albumen nor sugar.

Operation, March 7, 1894. The knee was opened by a vertical incision, the intervening fibrous tissue removed, and the bones brought together by force, and wired with No. 3 silver wire (French catheter scale) and the wire hammered into the bone; dressed on a Macewen splint. The external sutures were removed on the eighth day. A small abscess formed on the inner aspect of the knee, and another abscess in front of the knee, during the treatment. The highest temperature was 100° F.

March 4, 1894, the splint was removed and passive motion was begun. She could walk without aid. The leg could be bent to a right angle and was still improving, when she was discharged March 14, 1894.

Case III.—S. J. DeH., Meyerstown, Pa., aged forty-two years, was sent to the Jefferson Hospital by Dr. Krum, of Lebanon, January 8, 1895.

Six months previously, by an accident on the railway, he struck his right knee and fractured the patella transversely. The fracture was treated with adhesive strips and a posterior splint, and he recovered with an interval of one and a half inches between the fragments. Last September, by a misstep, the fragments were dragged farther apart, so that they are now separated two and a half inches in extension and five inches when the leg is flexed. The function of the joint is very much impaired.

Operation, January 9, 1895. I exposed the patella by a vertical incision in the axis of the leg, dissected away the tissue between the two fragments, and sawed off a portion of each. With all the traction I could make upon the fragments they were still separated two and a half inches. Accordingly I prolonged the incision upward and downward, and repeated the operation described in Case I. Cultures made at the time gave a negative result. I was now able to bring the fragments into very satisfactory apposition. The twisted end of the wire I hammered into the bone. The ligamentum patellæ was firmly attached to the tibia by lateral fibrous tissue. The point of the V was so tilted forward that I removed it with bone pliers. The wound was then closed by interrupted sutures.

His temperature after the operation rose to nearly 100° and 102° F. for about a week. This was due to the accumulation of blood at the site of the cross-section of the muscles. Some stitches were removed and the wound irrigated two days after the operation, when his temperature gradually fell to the normal. After five weeks of extension and elevation of the leg by a posterior splint passive motion was begun, and when he left the hospital on March 6 (eight weeks after the operation) he was able to bend the leg over one-third of the full flexion. The fragments were very slightly movable upon each other.

## REMARKS.

My experience in these cases is very favorable to the combined triple operation of wiring the fragments of the patella, section of the quadriceps muscle, and chiselling loose the tibial attachment of the ligamentum patellæ when the two fragments cannot otherwise be brought into apposition. No reaction followed the larger violence, and the only unfavorable point was in connection with the section of the quadriceps at the upper end of the incision. This leads me to suggest the following modification of the technique:

First, I shall hereafter make an anterior *flap* of skin beginning on a level with the upper border of the patella and extending downward an inch below the tubercle of the tibia. When this is dissected up, the operative procedures in wiring the patella and, if need be, chiselling loose the tubercle could be undertaken as usual, and then the line of union of the patella and the wire and the point at which the tubercle is chiselled loose will not be exposed to possible infection or other accident by lying immediately behind the line of incision, but will be entirely covered by a solid flap. If it is necessary to divide the tendon of the quadriceps or of the rectus alone above the patella, this can be done by an entirely independent incision, which could be drained, if need be, and the possibility of contamination of the knee-joint by accumulation of blood-clot through the long incision be avoided.

# TRANSACTIONS OF THE SECTION ON GENERAL SURGERY OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA.

*Stated Meeting, April 12, 1895.*

Dr. William W. Keen in the Chair.

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## CATHETERIZATION OF THE URETERS IN THE FEMALE.

Dr. George E. Shoemaker read a paper on "Catheterization of the Ureters." (See page 650.)

Dr. John B. Roberts thought that Dr. Shoemaker's method deserved to be adopted by all who have to resort to these operations. In a case of suspected renal calculus impacted in the ureter, an attempt at catheterization was made by his colleague, Dr. Fullerton, but the instrument could not go through the ureter. A section was then made, a nephrectomy done, and a catheter was inserted into the ureter: but it stopped within two inches of the bladder. He then turned the woman over and Dr. Fullerton introduced a catheter again into the vesical end of the ureter and found that the instrument passed by the other one. By this means he located a small stone in the ureter, which may have been due to a pelvic abscess, for which a cœliotomy will be done at some future time. While this is not exactly a case of the kind contemplated by Dr. Shoemaker, it is analogous. The ureter was simply sutured to the wall of the back, and the wound healed up. The patient was a great deal better for a time after the operation.

## URETHRAL CALCULUS.

Dr. Orville Horwitz read a communication on "Stone in the Urethra." (See page 655.)

## THE TREATMENT OF FRACTURE OF THE PATELLA.

Dr. J. William White read a paper on "Treatment of Fractured Patella" and presented three cases.

Dr. W. W. Keen read a paper on "Treatment of Old Fractured Patella by Wiring the Fragments." (For these papers, see pages 661, 671.)

Dr. John Ashhurst said that in considering the treatment of fractured patella a good deal of stress should be laid upon the character of the fracture; a fracture of the patella in one case is not the same as a fracture of the patella in another case. The patella in structure is a sesamoid bone, and he thought that its functional importance had been exaggerated. For many years it was supposed that a man with a broken clavicle could not lift up his arm above his head, but this was shown to be a mistake; the patient could lift the arm, only it hurt him too much, and this is the reason why he does not do it. Similarly, it has been supposed that a man with fractured patella could not walk; but it has been ascertained that this is not so. During a campaign, while certain soldiers of the French army were scouting, several cases of fractured patella occurred. Having the choice before them of walking back to camp or of being captured, they walked home. If the patella is broken and there are no complications, the disability is very slight, as it is only a sesamoid bone. If the fibres of the lateral capsular expansion of the tendon and the attachments all around the bone retain their integrity, the patient still has the power to extend the leg as well as he did before the patella was fractured. After excision of the patella, as in gun-shot wounds, after the patella is all taken out, which is really the best treatment, the function of the quadriceps tendon and movements of the limb are not interfered with. Therefore we may conclude that a great many cases of fractured patella will recover and have a very useful limb without any special method of treatment. My own experience had been that in simple fracture of the patella, in the majority of cases, by the ordinary method of treatment a satisfactory result will be obtained. Perhaps not so good as Dr. White obtains, but fairly good. There are cases in which there are five or six inches of separation, and yet the patient is able to walk about and attend to the ordinary duties of life, such as a sailor going up aloft and so on. This is because the fibres of the quadriceps tendon are not broken.

Dr. Jonathan Hutchinson maintains that the sole cause of the separation of the fragments is effusion into the joint. The upper fragment is not drawn up by the fibres of the muscle, but it is forced up by the effusion. All that is necessary is to remove the effusion in order to secure apposition. Not feeling like relying absolutely upon this method, the speaker put on splints and elevated the limb. He did not like to let the patients sit up in the chair as recommended by Professor Hamilton, because he thought they were more comfortable in bed. In the great majority of cases nothing more is needed. It is best that the dressing should be applied as promptly as possible to anticipate any shortening of the muscle, and it should be readjusted from time to time, so as to follow up the subsidence of the swelling, when the upper fragment can be brought down in close contact, though not at first. A firm fibrous union is just as satisfactory as the results of any of the dangerous cutting methods.

In fact, the disability after fracture of the patella is not all due to inability to throw the limb forward, but is often due to anchylosis. It is necessary for some six months after the injury to keep up some kind of support so as to prevent possible injury, and as a result some stiffness will result, but this will pass off by the physiological use of the limb and yield a perfectly satisfactory result. He had been obliged to resort to the use of the wire suture in only a single case; in this case there was entire separation of the patella and rupture of the ligament at the side. He also had made a number of transverse scorings in the under side of the ligament to lengthen it, though not to the extent that Dr. Keen described.

He said that one method of treatment which had been brought forward of late years seemed to him to be judicious and promising. The method he referred to was to place an acupressure-pin transversely through the soft tissues and tendon just above the patella and another through the ligamentum patellæ, and then throw a ligature around these pins to hold the fragments in apposition. It is impossible in this method to open the joint as with Malgaigne's hooks and less likely to excite inflammation of the skin. The procedure is simple and can be easily performed, Although he had not yet used this method, it commended itself to him.

He questioned the fact of bony union and referred to Sayre's case, which in the dry specimen appeared to be united by bone, but after soaking for a time in alcohol it was found to be only ligamentous. The arguments with regard to bony union are misleading and theoretical; the ligamentous union is just as good as a bony one.

As regards the comparative value of methods of treatment, he would give the preference to those which did not enter the joint over those in which the joint is implicated.

Dr. Keen said that he had seen a case of fracture of the patella which occurred subsequently to the healing of a former fracture. The line of the second fracture did not coincide with that of the former, which would prove that the ligamentous union was stronger than the rest of the bone.

Dr. G. G. Davis thought that the interposition of fibrous bands of tissue might delay healing, but would not produce markedly deleterious results, and that their influence in producing such results had been exaggerated. In a case of fracture of the tibia, which he had treated conservatively without operation, the fascia was puckered in by the lower fragment. In six weeks there was firm consolidation, therefore, while the interposition of fibrous tissue might have interfered with the rapidity of healing, it did not prevent union in this case. There are cases in which, after waiting a few days, the swelling may go down and the fragments may be approximated without any trouble. When this occurs, he believed that approximation with adhesive strips and bandages will produce satisfactory results. In other cases, where the effusion is so great as to widely separate the fragments, he would tap the joint and irrigate with normal salt solution, and then use Malgaigne's hooks. In a case where the separation amounted to about three-quarters of an inch, he had opened the joint and found that a projecting spicule of bone from the lower fragment had prevented approximation. He simply pushed the spicule backward and approximated the fragments with Malgaigne's hooks and united the skin beneath. This is the method of Mr. Treves and is superior to any method which leaves a foreign body in the joint. The success of Dr. White depends upon the fact that he does not use the needle to penetrate the joint, but makes an incision which permits drainage to occur. The passage of a silk thread through the joint seems a great source of danger, as it has been shown that it is impossible to disinfect the deeper layers of the skin, and the silk fibres constitute an immense number of capillary tubes through which infective material might be carried into the joint. Silk has not been very satisfactory in surgery. In spite of every precaution, stitch-abscess will often result. In the abdominal operations, silk ligatures cause sinuses; in the inguinal canal and in ligation of arteries, silk has proved unsatisfactory. Still, it may be that in a certain class of cases, as in this operation of Barker, the silk ligatures might prove a successful feature.

The good results obtained by Dr. White are attributable to the fact that he practises passive motion early, and not because he uses the silk ligature. Champonniére depended upon wire, so that his patients could walk soon afterwards, as the rule. If a modification of Malgaigne's hooks could be devised, which would allow of the same passive motion as other methods, they would give better results. There is some motion even with ordinary Malgaigne's hooks, and in preference to allowing any foreign body to enter the joint, he would prefer the use of the hooks, as suggested.

Dr. John B. Roberts said that his experience had led him to the conclusion that in transverse fractures of the patella due to muscular force, a few cases might be treated with adhesive straps and supporting apparatus ; but the majority of these cases, however, should be treated by Malgaigne's hooks modified by Dr. Levis. He had himself had good results from this method and had witnessed them in the hands of others. For such a fracture he would not want to have a joint opened in his own body ; but he would, however, be willing to have the joint opened if there were very extensive separation of the fragments. The opening of the joint with antiseptic methods is not a very serious operation. In compound fractures he would use the open method ; but in other cases he would not use it, simply because there would be a failure of antisepsis.

After fracture of the patella, he doubted if bony union ever occurs. Some years ago he had seen a specimen which he believed to be an illustration of bony union, but on macerating it for a while it wobbled about like a hinge, when it again dried it looked like bony union and the fibrous tissue could not be detected. In fact, it does not matter whether the union is bony or ligamentous, if it is firm. In conclusion, he exhibited a plaster cast of a fracture of the patella, with a separation of three inches between the fragments. The patient was able to walk, and was brought into the hospital with a dislocation of the tibia and fibula backward and a fracture of the patella of the opposite leg, for which he was treated in the hospital, and while there he called attention to this old fracture of the other patella, which was well shown in the cast.

Dr. Joseph Hearn had never treated a case by the Barker method, but always followed the old plan of elevating the limb and using adhesive plaster and a posterior splint. In a recent case treated by him, when he moved his hand over the patella he could not tell whether it was bony union or not, but on careful examination, he found it to be ligamentous. He had keep a supporting apparatus on for six months, and the patient, while he claimed to have perfect use of the limb, could not flex it quite as well as he should, probably from the cause assigned by Dr. Ashhurst.

Dr. J. William White, in closing the discussion, said that the whole matter turns on what is regarded as a satisfactory result. The term is a very vague one, and depends upon the mind of the surgeon and the mind of the patient; but he had not seen any results from what has been termed the old-fashioned treatment which would compare with those he had obtained from the operation illustrated by the patients he had presented. This was not claimed alone by him, but also by others who had used this plan. It is a question in the first place of shortening the time of treatment. Dr. Ashhurst has spoken about wearing apparatus for nine months, and a year may pass before there is good use of the limb; while one of the men, shown by him, had been operated upon only eleven weeks before, and yet is already attending to his work without any apparatus. This is the most striking result that he had seen from this plan of treatment.

The objection to the use of Malgaigne's hooks is that there is no provision for the removal of effusion or of blood-clots, which may afterwards become organized. From the opening of the joint comes not only blood-clots but bloody synovia in considerable quantity, which, if allowed to remain, would interfere considerably with subsequent repair.

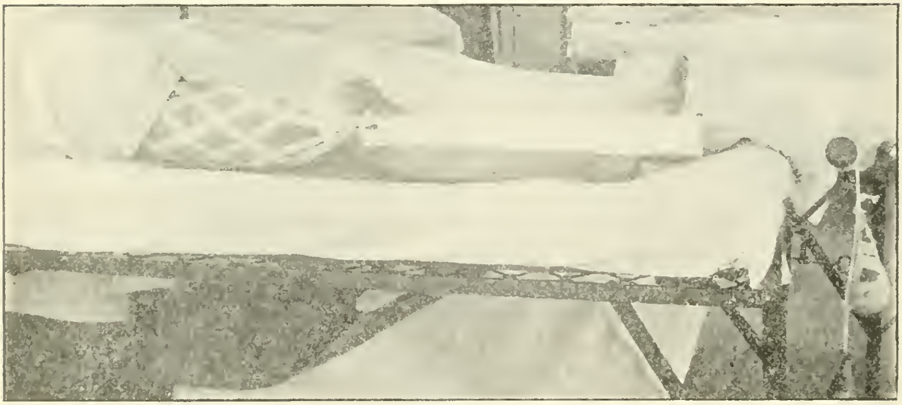
He did not attach much importance to the question of bony union. In one of the cases presented this evening, Dr. Keen thought it was bony union and Dr. Ashhurst thought it was not.

Viewing the subject clinically rather than from the stand-point of pathological museum results, he called attention to the fact that two patients were present who had only been in bed a few weeks, both of whom were back at their work inside of two months from the time of injury. The third one was discharged from the hospital and is now back at work in eleven weeks. The union of the patella is perfect, and the lower fragment is in apposition with the upper without separation.

Dr. Keen's case was very interesting. Staff Surgeon Cameron had recommended transverse incisions in the quadriceps muscle, and Lister had nicked the muscle and added considerably to its length; but the cutting of the tubercle of the tibia he believed was new.

## A MODIFIED EXTENSION APPARATUS FOR THE TREATMENT OF FRACTURE OF THE PATELLA.

Dr. William Barton Hopkins presented an apparatus for making extension in cases of fracture of the patella. The apparatus shown in the accompanying illustration will be seen to act like an Indian puzzle, which is, as familiarly known, a small cylinder of wicker work, which, owing to its peculiar arrangement, closes itself more tightly about the finger the more it is drawn upon. The apparatus consists simply of a basket-like series of half-inch rubber straps, so applied that their lower ends terminate at points to the outer and inner side of the knee and are attached to rings. To these the ordinary extension apparatus with pulley and weight is fastened. This part of the apparatus is intended to relax and draw down all the tissues of the thigh, while traction upon the upper fragment of the patella is obtained by two or three rubber straps carried across the latter and made fast to the rings. After the appliance has settled into place, the lower fragment may, if necessary, be supported by one or two straps carried upward. The essential feature, and the only one which is novel in the device, is, of course, the basket-like arrangement of the straps, as extension with adhesive plaster or leather has long been employed. He had found it most comfortable to the patient and entirely satisfactory in cases where there is little separation of fragments. It paralyzes the mus-



Hopkins's modified extension apparatus for the treatment of fracture of the patella.

cles of the thigh by its steady, unremitting pressure and draws down the upper fragment, and yet causes no tendency to swelling of the limb below. So far as he had been able to observe, it acts as well when the patient sits up as when he lies down ; indeed, when it is remembered that flexion of the thigh on the abdomen lessens the distance between the origin and insertion of the quadriceps extensor of the thigh, there seems no reason why sitting up should do harm, provided the change in posture can be made without any muscular contraction.

# REVIEWS OF BOOKS.

SYSTEM OF SURGERY. Edited by FREDERIC S. DENNIS, M.D., Assisted by JOHN S. BILLINGS, M.D., Vol. II. Minor Surgery, Plastic Surgery, Military Surgery, Diseases of the Bones, Orthopædic Surgery, Aneurism, Surgery of the Arteries and Veins, Surgery of the Lymphatic System, Diseases and Injuries of the Head, the Surgery of the Spine, Surgery of the Nerves. Philadelphia: Lea Brothers & Co., 1895.

The high standard of the first volume of this work is maintained in this, the second. The chapters are full, well written, and well illustrated.

A perusal of the section on bandaging will well repay the surgeon whose reading is more in the line of major work; for it is a matter of fact that, as a rule, the man who administers the anæsthetic is more expert in the art of bandaging than the surgeon who performs the operation.

This chapter is full of practical hints, even to informing the surgeon of the best method of removing plaster of Paris from the hands. Poultices, counter-irritation, cupping, and venesection are dealt with under the head of minor surgery. Here we also find remarks on artificial respiration, aspiration, hypodermic injections, massage, enemata, and vaccination,—all, indeed, surgical subjects, but usually found wanting in books on surgery. We cannot commend the author for illustrating such unused contrivances as the porte-moxa and the old-fashioned cautery-irons; nor do we think that so much space need have been given to illustrating and describing the rapidly-becoming obsolete methods of direct and indirect transfusion of blood. For irrigating the bladder, "a syringe, or, better, a rubber bulb, holding about a pint,'' is recommended, no mention being made of the more safe and convenient douche-bag.

In this chapter are also treated the subjects of sutures and the treatment of hæmorrhage.

The chapter on plastic surgery is a most admirable one. First are dealt with the general principles and methods of plastic surgery. The illustrations are numerous; and, as is not always the case in medical works, each picture which the author has introduced illustrates definitely and positively the feature which it is intended to show. After dealing with the general principles of plastic work, special plastic surgery is taken up. The new knowledge on the subject of bone-grafting is found in this chapter; and the author's own clever device for the treatment of webbed fingers.

A masterly and exceedingly interesting essay is that on military surgery. This chapter will not only hold the attention of surgeons, but will appeal to all who are interested in military organization. Its author deserves the highest praise.

It would be difficult to crowd into the limited space given to that subject more information concerning the diseases of bone than its author has succeeded in doing. Fifty-six pages is a small space for an author, so capable of writing fully and elaborately, in which to condense this important subject.

The same may be said of the hundred pages on orthopædic surgery. It seems hardly fair to ask an American author to cover this broad subject in so small a space, when Hoffa spreads his knowledge of the same subject on 750 pages. We would criticise the author for making a plea for the elimination from scientific nomenclature of such terms as "Pott's disease," when, with his plea still glaring in our eyes, we find him repeatedly employing these very objectionable terms further on in the chapter. It is not true that the operations of Hoffa and Lorenz for congenital dislocation of the hip "differ very little in their essential features," and that "the structures to be divided are about the same."

The chapter on aneurism is good. Special aneurisms are written of by Dr. Percival R. Bolton, whose name does not appear in the list of authors. This chapter contains analyses of cases and much statistical information.

In the section on the surgery of the arteries and veins quite a full list of the methods of treating varicose veins is given, with the statement that "the list is sufficiently complete to illustrate the principles upon which all the operations are based." Nevertheless, the operation of ligation or compression of the saphenous vein is not included in the list, which method is based upon the hydrostatic principle of removing the pressure from the diseased veins, and has received much attention of late, and its value has been practically demonstrated upon a large number of cases.

The chapter on the surgery of the lymphatic system is worthy of especial note. The diagrams of the lymphatic system, showing areas drained by the various channels, are new and instructive. Scrofula is disposed of in masterly style. The section on filariasis and the diseases dependent thereon is clear and interesting. The author regards elephantiasis as due to the filaria.

The diseases and injuries of the head are well classified. The chapter begins with diseases of the scalp; then tumors of the soft coverings, bone, and brain are taken up. Such rare conditions as aplasia and imperfect osteogenesis of the bones of the skull are beautifully illustrated. Injuries to the head previous to birth are considered. The author states his indebtedness to Macewen's work on "Infectious Diseases of the Brain," for the points on the surgical anatomy of the skull.

Fractures of the skull and brain injuries are broadly discussed. Attention is called to the diagnostic value of percussion in locating abscesses of the brain.

There is not as much information as we should expect on the subject of cerebral localization. In speaking of an illustrative case of abscess of the brain, the author says, "A middle-aged man, whose boy had been a patient of mine, suddenly developed furious brain symptoms,'' etc. We fail to discover that the boy had anything more to do with the case than the man's cow had.

This section on the surgery of the head is one of the fullest and best in the book.

The chapter on the surgery of the spine is full of practical ideas, and was written by a man of much experience and learning.

The volume ends with a well-written chapter on the surgery of the nerves.

This work is rich in references. Naturally, authors refer most frequently to the literature of their own country, but in no medical works do we find such complete references as in those by American authors. No scientific literature is richer than that of the Germans; but, because of the fact that their writers often assume that there is little of value or importance outside of their language, they are often guilty of gross inaccuracies. This is especially true in their compilations of statistics.

This work of Dennis has been characterized so far by a fulness, an honesty, and frankness of statement which must command the confidence of surgeons everywhere.

JAMES P. WARBASSE.

# CORRESPONDENCE.

## INTESTINAL ANASTOMOSIS,—MAUNSELL'S METHOD OF SUTURE.

To the Editor of the ANNALS OF SURGERY.

SIR:—In the August number of your journal appears an extract of an article entitled, "A New Intestinal Suture," by Dr. Emmerich Ullman, of Vienna, which was published in the *Centralblatt für Chirurgie*, No. 2, 1895, in the course of which the following statement is made:

"The method he has adopted was first theoretically suggested by an Australian physician, Wydenham Munsell, but first performed by Ullman upon a patient in December, 1894, after having practised upon cadaver and living animals."

Permit me to call attention to the fact that the late Professor H. Widenham Maunsell performed an intestinal anastomosis by his method on a patient during December, 1886, which he recorded in the *Lancet*, February 13, 1892. Successful cases of intestinal resection and anastomosis, in which this method was employed, have been performed and recorded by Dr. Frank Hartley (May, 1892), *New York Medical Journal*, Vol. LVI, pp. 302 and 464, and by the writer (September 12, 1893), *New York Medical Journal*, January 20, 1894, who had also, previous to operating on the human subject, practised on the cadaver and on living animals several years prior to Ullman's efforts in this direction.

FREDERICK HOLME WIGGIN, M.D.

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# OPERATIVE TREATMENT OF EPISPADIAS BY TRANSPLANTATION OF THE URETHRA.

By F. V. CANTWELL, M.D.,

OF TRENTON,

SURGEON TO THE ST. FRANCIS HOSPITAL.

IN all cases of reparative surgery, in which the defect is congenital, the aim of the surgeon should be to restore the parts to their normal relations as nearly as possible. To effect this, it is necessary first to give a thought to the cause of the deformity.

As to epispadias,—the corpora cavernosa in a normal penis are so intimately attached that it is impossible to separate them without injuring the bodies themselves. They seem even to have decussating fibres. The same bodies in an epispad can readily be torn apart, having no connection save by some loose areolar tissue; they simply run parallel.

This fact is strong proof of Thiersch's theory that the condition is not one of failure of development, but of traumatism to the fœtus. Probably a tearing of the urethral roof by dammed-up urine.

The roof being torn, the cavernous bodies are separated, and the floor of the urethra with the remains of the spongy body come up through the gap thus made, really being everted. Then kind nature—who always makes the best of everything—allows the parts to heal in this position and an epispad is formed. The mechanism of the injury strongly brings to mind what occurs when a grain of corn pops on the stove.

Granting the above to be true, the best operation for the condition would be one that would reverse the conditions of the accident,—that is, loosen up the urethra from its unnatural attachments, separate the cavernous bodies, replace the urethra in its normal position under the penis, and bring the two bodies up over it, thus obtaining an almost normal organ.

This conclusion was reached after careful dissection of a complete epispad, and has been proven to be just by the results following operation in two complete cases.

It would be difficult to understand the technique of the operation without reference to the accompanying diagrams.

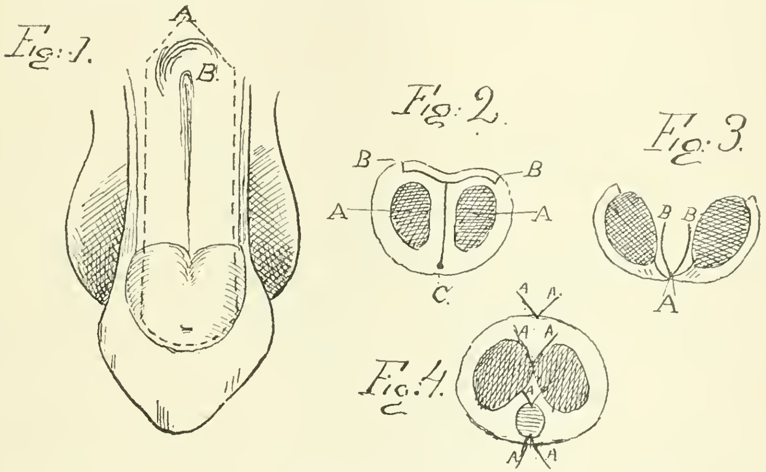
It is necessary first to establish a bladder fistula in order to divert the urine from the place to be operated upon. This is best done by pushing out the perineum with a finger in the bladder and cutting down upon it. This plan was first used by Thiersch.

I found the perineal drainage-tube, devised by Francis S. Watson, to be an excellent instrument to use during the course of cure. The tube is pictured and described in the "System of the Genito-Urinary Diseases," etc., edited by Prince A. Morrow. With it I see no advantage in waiting a week or ten days before operating on the penis. Both operations might be done at one sitting or on succeeding days, thus saving a great deal of time.

First look closely and find where the mucous membrane of urethra and the skin of the penis come together, this seems to me to be a marked line of scar tissue. Along these lines on either side of the penis two parallel incisions are made extending from the symphysis out to the extremity of the glans penis. These incisions are to be made down to the cavernous bodies without injuring them and also made to join above the bladder opening as at *A*, in Fig. 1. Then a flap is to be formed of the whole urethra from the glans as deep into the infundibulum as the operator thinks advisable. This flap is *B*, *B*, in Fig. 2. The urethra is held up out of the way while the cavernous bodies are separated either by light touches of the knife or by blunt dissection; in fact, they can be pushed apart with the end of the finger (see Fig. 2, *C*). A slight incision is necessary in the glans.

The urethral flap is then laid in the gutter thus formed, and held in position by two sutures through mucous membrane and skin tied on under surface of penis (see Fig. 3, *A*).

A silver catheter is then laid in the urethra and a canal is formed by continuous suture of the free edges of the mucous membrane. Above this the corpora cavernosa are brought together, and retained by a continuous suture. The skin is usually so abundant that it can be brought together above this. Then a few well applied deep sutures are put into the skin and fat of the mons veneris, leaving a penis that looks normal save for a straight line of sutures along the dorsum (see Fig. 4).



EXPLANATION OF DIAGRAMS.

FIG. 1.—The dorsum of the penis in a complete epispadias. *A*, The dotted line represents the line of incision for urethral flap. *B*, The infundibulum or opening into the bladder.

FIG. 2.—A transverse section of an epispadias. *A*, *A*, The corpora cavernosa. *B*, *B*, A transverse section of flap composed of urethra, and, if necessary, the remains of the corpus spongiosum. *C*, The line of incision between the corpora cavernosa down to the skin on the under surface of penis.

FIG. 3.—A transverse section of an epispadias showing the cavernous bodies separated. The urethral flap (*B*, *B*) laid in the gutter and a retention suture (*A*) in place.

FIG. 4.—Transverse section of penis after operation showing the sutures (*A*, *A*, *A*, *A*) in place.

There are several questions that present themselves in this operation.

The patient should be at least ten years of age, for at that time the penis has developed so much as to make manipulation easy and the cavernous bodies are firm; besides, the child will have passed through that dangerous period of infancy in which death so often comes.

I think it is best to dissect the mucous membrane clear of the glans and transplant it instead of making two converging incisions on either side of the urethra, after the manner of Thiersch.

All bleeding is readily controlled by the sutures. The best material for sutures is catgut for the buried ones and silkworm gut externally.

The catheter should be left in until the healing process has well advanced, to prevent contraction and for the purpose of washing out the bladder and to keep the perineal drainage-tube clean.

As to waiting some days after the perineal fistula is made before doing the operation on the penis, the only advantage is that the time allows the ever-present excoriations to heal and gives a dry surface for operation. Otherwise five minutes suffice to make the fistula, and the operation can be completed at one sitting in forty-five minutes. I will relate two cases.

CASE I.—May, 1894; robust boy, aged eleven years; penis showed complete epispadias; arch of pubes present, but slender; parts badly excoriated by continual dribbling of urine: he kept his clothes dry by the use of very large thick pads of cloth.

Perineal fistula made and ten days allowed to elapse. The seat of operation was found dry and skin free from excoriations.

There was free bleeding during operation, but it was readily controlled. The urethral flap was unfortunately button-holed at the glans, this afterwards necessitated the use of bougies on account of the tendency to contract. The rest of the operation went smoothly. There was a great deal of swelling for some days after the operation, but this subsided. In three weeks the whole wound had closed, with the exception of a pin-hole opening at the site of the infundibulum. This persisted for six months, in spite of efforts to close it, when it finally closed.

At present (August, 1895) he has a good penis, which, instead of being drawn up to form a cork for an opening into the bladder, hangs pendulous as a normal penis does. He can get a firm erection, and, although he still dribbles somewhat, he is proud of the strength of the stream he passes. He retains his water for more than two hours. He wears a urinal and keeps dry, and is able to do some of the work around the farm.

Case II.—Aged seven years; similar in every way to Case I, except that I had attempted, a year before, to repair his penis by a flap operation, which was a dismal failure, and left the penis worse than before.

This operation was far more difficult than in Case I, on account of the smallness of the penis and the fact that the cavernous bodies were poorly developed. The child had tuberculosis of hip-joint and did poorly from the beginning. In spite of this, and of the fact that the wound suppurated, the incisions healed in a loose manner. Now (August, 1895), although the boy has not got a good penis, he has a canal to the end of it. He has slight control over his urine, and at times can pass a stream. He would be dry and comfortable with a rubber urinal.

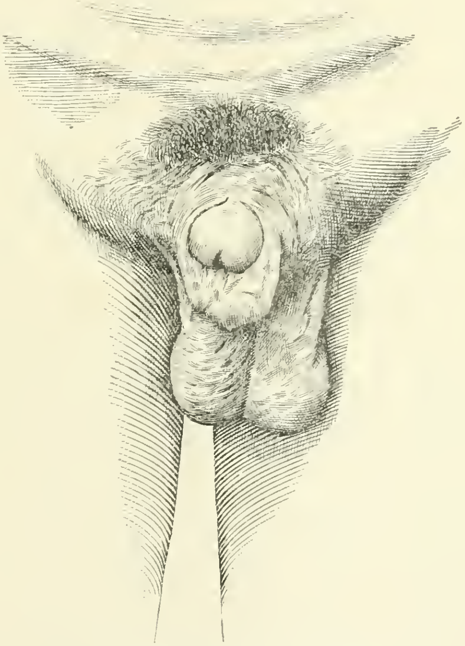


Fig. 5.—Result of operation for epispadias.

A proof that this operation is the typical one for this deformity is the fact that, when completed, we have a penis normal in the relation of its component parts and normal in appearance. That instead of a separate operation being needed to correct the upward curvature manifest in these cases, at the conclusion of the operation the penis is pendulous.

# TREATMENT OF EPITHELIOMA OF THE ALA OF THE NOSE.

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## I.

PLASTIC operations, by which defects of various parts of the nose are remedied, have not proved particularly successful. If the entire nose has been destroyed, any attempt to provide an efficient substitute by operative procedure is apt to prove futile.

Of the individual parts of the nose, however, none is more difficult to replace than the alæ.

This is certainly the most delicate part of the external nasal apparatus, being endowed with power of movements that result in the expansion and contraction of the nostril, and capable, through the medium of its cartilages, of withstanding atmospheric pressure, and of thus preventing the mechanical closure of the nostril, when for any reason the air in the nasal passages is exhausted, creating a temporary vacuum in that cavity.

These cartilages are several in number, delicate in their construction, and connected with one another by means of fibrous tissue, giving a compact whole to the alæ.

The preservation of the integrity of the alæ is very important, not only from a cosmetic point of view, but also to provide a suitable passage-way, through which respiration may take place, and in which the air as it passes to the lung may be freed from impurities, which might prove injurious if inspired into the lower air-passages. Usually, with the mouth and one nostril closed, sufficient air may pass through the open nostril to prevent even the slightest discomfort to the person who tries this experiment, but if, for any reason, the nostril becomes partially occluded, as, for example, by the congestion of an acute or chronic inflammatory process or by any of the hypertrophic changes concomitant with chronic catarrh, involving the turbinated bones, then the passage of air through this narrow channel is impossible, and, as a result, air must pass through the open mouth without suitable filtration.

The change in the voice of a patient whose nostril does not readily admit the passage of air is also a disagreeable feature in many of these cases. This becomes decidedly nasal and indistinct, and is a source of constant annoyance to the patient and his friends.

When from any cause the ala is destroyed, be it from traumatism or syphilis, or when it is necessary to sacrifice this part in the removal of an epithelioma, its restoration, and that of the adjoining portion of the nostril, in such a way as to again be able to transmit air becomes a matter of the greatest importance.

This may be accomplished by a plastic operation, in which the gap, produced by the removal of the normal or diseased ala, is closed by a flap, which, taken from the corresponding cheek or from the opposite side of the nose, is sutured to the edges of the defect. The new ala thus formed consists externally of skin and subcutaneous—with perhaps some muscular—tissue, and must necessarily have internally a raw surface that is eventually destined to be covered in the process of cicatrization with a layer of cells, which shall serve the purpose of a mucous membrane.

These operations are planned naturally in such a way as to avoid unnecessary scarring, and at the same time it is advisable to preserve symmetrical facial expression by taking the flap as near the median line as possible, and so avoid damage to the underlying muscles of the face and the filaments of the facial nerve that innervate them.

The primary result is frequently good. The defect is closed. There is a poor imitation of a nostril, which, however, admits air, and the cosmetic appearance of the patient is not seriously damaged.

Unfortunately, however, this flap is not capable of resisting atmospheric pressure, and with every inspiration it is pressed inward towards the nasal cavity, thus constricting the orifice of the new nostril.

As this statement does not entirely agree with the mechanism of the normal nostril, as taught by physiology, a few words of explanation will not be amiss. Under normal circumstances, the effect of a forced inspiration upon the size of the nostril depends upon the behavior of the muscles that control the size of this opening. With contraction of the dilator muscles, the nostril increases in size, and as long as contraction continues it is enabled to support atmospheric pressure in the same way as is the cavity of the thorax, when its diameters are increased by the contraction of the muscles of inspiration, enabled to withstand the effect of a similar pressure. If, on the other hand, the dilators do not contract (and this is perfectly possible) a sudden inspiration exhausts the air of the upper nasal passage, and to assist in filling this temporary vacuum, the alæ relaxed, are driven inward and flattened by the pressure of the outside atmosphere.

The new ala, formed by the plastic flap, is, of course, not furnished with any muscular apparatus, and is consequently incapable of any change in calibre on the volition of the patient. The size of its orifice is therefore diminished to a greater or less extent by each inspiration, according to its depth.

The constantly-increasing diminution in size of the new nostril, which, from its very nature, is necessarily permanent, is also due to the subsequent behavior of the cicatricial tissue, which eventually covers the granulating surface of the inner side of the flap, forming the inner wall of the new ala, and the outer wall of the nasal passage. This follows the law of all scar tissue, in that it contracts, and as a natural sequence the outer surface of the new ala, from being originally convex, becomes later flat, and then puckered, or even slightly concave, as it is drawn more and more towards the nasal cavity. This, of course, not only diminishes the size of the new nostril, but produces an asymmetry between the two alæ, yielding an undesirable result.

For the purpose of obviating these defects so far as possible, the following operation was performed in the case herewith reported, with a very satisfactory result.

Case I.—C. F., male, aged forty-nine years, was first seen by me in consultation with Dr. B. F. Vasburgh, June 25, 1893.

Three months before this time a "pimple" had appeared upon the left ala of the nose, which was scratched by the patient, and became thereafter a "running sore," continually increasing in size; no tubercular or specific family or personal history. Has had for years past a moderate naso-pharyngeal catarrh.

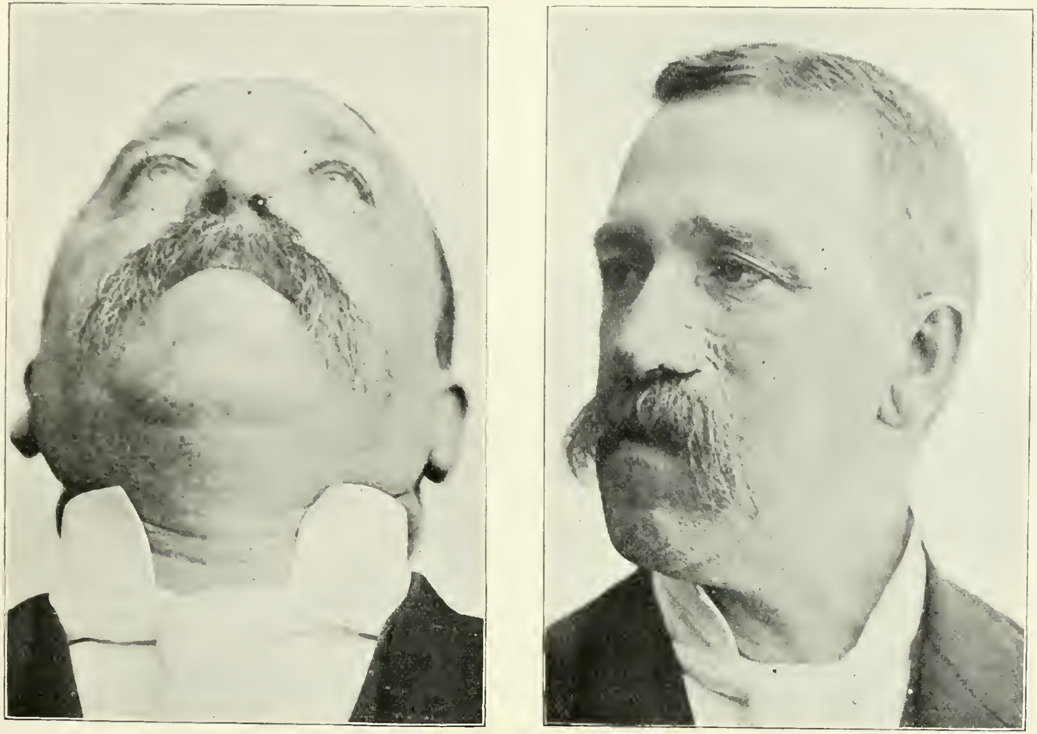
The patient neglected to consult a physician until June 18, 1893, when caustic was applied to the growth, resulting in a still further increase in size.

Examination, June 25, reveals an oval growth, involving the entire right ala of the nose, markedly elevated above the surrounding surface of the normal skin, the centre of which is moderately excavated, and in a condition of typical epitheliomatous ulceration, which extends over nearly the entire area of the tumor. In its vertical diameter the growth measures seven-eighths of an inch; in its transverse, five-eighths of an inch; its surface is densely hard, its edges indurated and markedly everted; the growth, however, being moderately distinct from the surrounding parts.

Inferiorly it extends almost to the junction of skin and nasal mucous membrane; the mucous membrane forming the interior of the nostril is not ulcerated, but evidently adherent to the overlying growth.

There is a moderate discharge of unhealthy matter from the surface of the growth. No glandular enlargement can be detected. The patient's general health is excellent.

*Operation—Ether.*—The epitheliomatous growth was thoroughly removed, leaving a quadrilateral defect where the ala of the nose had previously existed. The inferior side of the mass removed consisted of the upper and external wall of the nostril. The internal of the tissues of the side of the nose, three-eighths of an inch from the median line of the dorsum, extending into the nasal passage, the superior of similar tissues, extending down to the natural fold between the nose and the side of the face, while the external was composed of tissues lying in the above groove, which is the line of demarcation between the nose and the face. From this it can readily be perceived



CASE I.—From beneath. Two years and four months after operation. Side view.

CASE II.—Four months after beginning of treatment.

that the whole left ala of the nose, including its cartilages, was removed, the outer surface presenting the new growth, the inner surface consisting of mucous membrane on the point of ulceration, to which the epithelioma had become adherent.

The line of incision everywhere penetrated the nasal cavity, and in being carried down through the above-mentioned groove left only a very slight portion of the ala projecting from the anterior aspect of the face.

Hæmorrhage was considerable from the edges of the defect, and absolute control was difficult, owing to the dense structure of the tissue through which the incision passed.

This was, however, finally accomplished by ligature and pressure, and the second step of the operation followed.

This consisted of mapping out a slightly irregular quadrilateral flap, convex inferiorly, its other sides perfectly straight, from the tissue of the front of the face immediately external to the defect.

Its base of attachment corresponded to the situation of the outer side of the defect, being here left attached to the superior maxilla, its diameter in the transverse direction being about one-third greater than the similar diameter of the defect, the thickness of the flap being composed of skin, subcutaneous tissue, and even muscle, the thickness of the flap being equal throughout its entire extent, especially so at its circumference, which is to be sutured eventually to the margin of the defect.

In the dissection of this flap from the tissues of the face the facial artery is necessarily divided along its inferior edge, and some terminal branches of the ophthalmic, which descend from the inner angle of the orbit to meet the terminal branches of the facial, are divided along its superior edge. Although in this way the blood-supply of the flap is materially diminished, yet it was found that the anastomotic circulation was sufficiently abundant to preserve its vitality through the attachment of its *inner* edge or base to the superior maxilla.

As a matter of fact, the facial artery penetrates the flap at a distance so near the base of the ala that it would be possible to leave it undivided until the vitality of the flap in its new position is assured through other sources. In order, however, to make a nostril similar in shape to the normal opposite nostril, the dissection of the flap, inferiorly, must be carried through the facial artery to the point of the attachment of the flap to the bone, and it is better not to postpone this step of the operation.

After control of hæmorrhage, the flap thus formed is turned upon itself (or "everted") on an axis, passing through its base of attachment to the bone over ninety degrees until its outer edge comes in contact with the inner edge of the defect, which are then sutured together with fine silk.

The superior edge of the flap should be in contact with the superior edge of the defect, and secured in this position by sutures. The inferior edge forms the circumference of the new nostril.

The internal surface of the new ala is composed of skin, while the external surface presents a raw converse aspect of subcutaneous and muscular tissue.

The final step of the operation consists in the covering of the denuded area with skin-grafts. These should preferably be two in number, one for the convex surface of the new ala, the other for the quadrilateral space, on the anterior aspect of the face from which the flap was taken. The junction of these two grafts represents the furrow that is to be the line of demarcation between the new ala and the face, which is placed slightly external to the original line, the exact distance being the breadth of the base of the flap.

The ordinary dressing for such cases is then applied, the new nostril being moderately packed with sterilized gauze.

The patient reacted well from the effects of the operation, having been under the influence of the anæsthetic for more than an hour.

Two points of interest immediately presented themselves at the conclusion of the operation.

(1) Would the flap, in its position of semitension, receive sufficient blood to prevent sloughing?

(2) If it lived, would its necessarily-impaired vitality be sufficient to nourish and to cause to grow to its surface the grafts that had been placed upon it? Judging from the case just cited, both of these questions can be answered in the affirmative.

The face is one of the most vascular parts of the body, and, although the pedicle of the flap was no more than a third of an inch thick, it received sufficient nourishment from the branches of the facial, given off before its division, and from the terminal branches of the internal maxillary to prevent its sloughing.

It was, of course, more difficult to foresee the subsequent fate of the grafts. It was believed, however, that even if failure of union did occur that a secondary attempt would prove successful as soon as the surface of the new ala had assumed a granulating condition. There was no need of this procedure, however, as the primary attempt proved successful, and the grafts became firmly attached to the underlying surface of the flap. This took place by a process differing from the usual one only in its duration, inasmuch as fully thirty days elapsed before the process was completed.

Six weeks after the operation, the patient had an ala, of which both the external and internal surfaces were covered with skin, and a nostril which readily admitted air, and which remained patent in both inspiration and expiration. The immediate result of the operation was satisfactory. The cosmetic effect was good, the new nostril not materially differing from its normal fellow. The external surface of the new ala, to be sure, presented a roughened, uneven appearance, and its color was decidedly paler than the surrounding skin.

That portion of the face from which the flap had been dissected presented a depression, which, however, was gradually becoming more shallow. Could this condition be maintained, the success of the ultimate result would be assured.

One year has passed since the operation. During this time the uneven surface of the flap has gradually become more and more smooth, the color also has improved, closely resembling the surrounding skin. The size of the nostril remains the same, the surface of the ala is almost as convex as on the normal side. The original situation of the flap no longer presents a depression.

The tension of the flap seems to have provided it with an elasticity sufficient to support atmospheric pressure without the danger of collapse. If an ordinary piece of thin paper, quadrilateral in shape, and its surface flat, it carried through an arc of ninety degrees around one of its sides as an axis, which is securely fastened to any suitable structure, the resultant convex surface will support considerable pressure, and when depressed will, in virtue of its elasticity, tend to assume its former rounded appearance.

A great advantage, however, undoubtedly results from this kind of plastic operation, namely, that due to the presence of the natural skin, which, when the operation is completed, forms the outer wall of the nasal passage and the inner surface of the new ala.

This cannot undergo the gradual and constant contraction of cicatricial tissue, which, of course, is a great objection to flaps, lined by raw surfaces, in those varieties of plastic operations, previously mentioned, in addition it serves another important function.

Cicatricial tissue is very prone to break down and become ulcerated, especially when subjected to any form of irritation. In the nasal cavity irritation frequently arises in the discharge associated with inflammatory processes, and in people the subject of chronic nasal catarrh such discharges are very apt to be more or less constantly present, and the ulceration excited by them is therefore apt to be correspondingly intractable.

This is especially serious if, as in the case just cited, the ala has been removed for epithelioma, as the presence of such ulceration would be sure to favor a local recurrence of the disease. To be sure, the base of the outer wall of the old ala is left as a stump in the nasal cavity, but this is of small compass, and readily cicatrizing gives no further trouble. In the past year there has been no evidence at any time of intranasal ulceration, neither has any recurrence taken place. At the end of two years the condition is unchanged.

Naturally, knowledge derived by the treatment of a single case is frequently changed by subsequent experience with other cases, but the one in question presents sufficient interest to warrant its publication at the present time.

## II.

Caustic applications to malignant growths are invariably contra-indicated. Their thorough and wide removal by the knife, in the early stages of development, give the patient the greatest chance of permanent cure. It is only in this way that the entire growth, together with the lymphatics by which the growth gradually or rapidly invades the general system, can be successfully excised. If any fragment of the peripheral portion of the tumor, or of its exciting cause (whatever this may be), gains entrance into a neighboring vessel, it is rapidly carried to such a distant part of the body that no "local" operation, however thorough, will completely eradicate the disease.

No one denies the possibility of removal by caustic or other destructive agent of as much of the mass of a malignant tumor of several months' duration as can be appreciated by palpation. In this sense such growths may be said to consist of two general portions, one macroscopic, the other microscopic; it is this latter portion that makes the most radical of operative procedures uncertain in their ultimate cure of the patient, and it is just this portion that caustic applications, no matter how searching, must invariably fail to remove. In fact, there is no doubt but that such applications, in certain cases, hasten the propagation of the disease into the system at large.

In all cases, therefore, the knife must be considered the surest means by which the patient is to be protected from the danger of recurrence.

This is a rule, without exception, and one that cannot be too strongly or emphatically stated.

The rapidity with which malignant growths develop, in certain parts of the body, however, varies materially. Epitheliomata above a transverse line, passing through the ala of the nose, are not only of very slow growth, but it has always been a well recognized fact that the lymphatics running from the site of such tumors are, for some reason, usually exempt from the ravages of the disease. Older writers denied the possibility of such an occurrence, and considered any accidental lymphatic enlargement purely inflammatory. This, however, is not always the case.

Within the past year I have seen a rodent ulcer, involving the tissues under the left eye, of several years' standing, followed, after its complete and thorough excision by an able surgeon, by recurrence in the lymphatic glands beneath the angle of the jaw, the recurrence eventually terminating the life of the patient.

The fact of the escape of the lymphatics, however, in a majority of these cases, seems to justify an attempt, on the part of the surgeon, to remove by caustic such growths only when they have existed for years, and when the patient absolutely refuses the surer, quicker, and less painful relief afforded by the knife.

Such an attempt in the case just cited was certainly contraindicated, not only because of the rapidity of growth of the tumor, but also because of the necessity of some form of plastic operation to close the defect, produced by the loss of the ala, whether by caustic or by knife. Any plastic operation would probably have proved unsuccessful after the ala had been removed by caustic, for the reason that the edges of the gap would have been more or less uneven as well as the seat of a greater or lesser amount of inflammatory thickening, which, in itself, is capable of preventing the obtaining of primary union, so essential to the success of any plastic operation.

In the following case, however, the position of the epithelioma, the long duration of the disease, the apparent absence of lymphatic involvement, the free mobility of the growth on the underlying bone, and, most important of all, the absolute refusal of the patient to submit to an operation, notwithstanding his knowledge of the fatal character of the disease, seemed to justify an attempt to remove the growth by caustic :

Case II.—E. B., aged fifty-four years ; previous history negative. Seven years ago patient noticed the appearance of a "warty" growth on the side of the face, just external to the ala of the nose ; this very shortly afterwards became ulcerated, and has never cicatrized.

It has gradually increased in size up to the present time.

*Examination* reveals an irregular ulcer, extending outward from the right ala to the tissues of the face. It is about one inch long, three-eighths inch wide.

The surface is hard. Its edges hard and everted. The whole mass is freely movable upon the deeper part. The adjoining skin of the ala involved to the extent of one-quarter inch from its point of junction with the face. No lymphatic enlargement.

In the selection of a suitable caustic, one which produces the greatest degree of tissue destruction with the least degree of pain should be chosen. Caustic potash, caustic soda, arsenic, the mineral acids have been used for this purpose, but their application results in extreme pain, while the necrosis which ensues is sometimes more extensive than is desirable, and subjects the patient to the additional risk of pyæmia or other dangerous wound complications.

On the other hand, the action of chloride of zinc is more easily controlled, is attended with less pain, while the resulting albuminate affords a soil that, being destitute of nutrition, presents an effectual barrier to the entrance of germs or their products into the general system.

Applications of a paste, one-third of an inch in thickness, consisting of equal parts of flour and chloride of zinc (Canquoin), with one-twenty-fifth part of cocaine hydrochlorate was made to the epitheliomatous ulcer in question, overlapping the indurated edges of the growth. The resulting slough (usually equalling in its dimensions those of the applied paste) separated from the deeper parts in from five to seven days, leaving behind, after successive applications, a healthy granulating surface. By this means the entire growth was removed, with one-half the thickness of the adjoining portion of the ala, and the resulting ulcer, apparently healthy, cicatrized rapidly; the applications, four or five in number, were made at intervals of a week, and in seven weeks after the first application cicatrization was complete.

A most noteworthy feature of the result is to be seen in the condition of the cicatrix. This is not only much smaller than the original growth, as well shown in the accompanying photograph, but has not altered in any way the contour of the nostril or the line of the upper lip.

The primary result is, therefore, all that could be desired, from a cosmetic point of view. Whether the entire removal of the growth has been successfully accomplished time only will determine. In the experience of others, the cicatrix has frequently broken down in recurrence after a longer or shorter interval. This is to be prevented only by the thorough removal of the growth by generous, successive applications of the caustic to the base and surroundings of the ulcer, even after a healthy granulating surface has been procured. Absolute certainty of complete removal cannot, of course, in any case, be guaranteed, and even if the surgeon has been successful in this respect, the "disposition of the individual to the development of malignant growths" (if we may use the rather obscure term) may bring about a return of the growth, if not in the cicatrix, in its immediate vicinity, or even in some more distant part of the body. No recurrence after an interval of one year has taken place.

In conclusion, again, too great emphasis cannot be placed upon the superiority of the knife to the caustic, and in either case upon the necessity of keeping the patient under careful surveillance for a considerable period of time.

# INTRAPERITONEAL RUPTURE OF THE BLADDER.[1]

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THE following histories of intraperitoneal ruptures of the bladder are all that I have been able to find in the records of my own service in the Presbyterian Hospital. I was much impressed with the unfavorable outcome of the cases, and, believing that a more successful treatment could only come out of recorded failures, I have presented them to the Surgical Society.

CASE I.—Reported by Dr. Marvin. M. L., aged forty-eight years, Ireland, married, mason, was brought in on the ambulance, December 3, 1888; had been suffering since the day before with severe abdominal pain; denies intoxication, and emphatically denies having received any injury; did not sleep at all on account of the pain which he has had; no intermission; it is situated mostly in the hypogastric region, but extends into the left side; he also complains bitterly of an incessant desire to pass water and inability to do so; soft catheter passes easily, and gives issue to about eight ounces of bloody urine; reaction acid; color deep red; sediment 10 per cent.; specific gravity 1020; filtered solution albumen, 4 per cent.; blood and pus-cells in abundance. The pain continued after admission, and was of a very severe character, requiring hot stupes and the hypodermic use of morphine; in a few hours he again complained of the intolerable desire to urinate, which was relieved by the previous catheterism; the instrument was again introduced, and drew off eight ounces of clear urine. Testicles still retracted, and abdominal muscles so tense that nothing is revealed by palpation. Catheter used at 3 P.M. and at midnight.

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[1] Read before the New York Surgical Society, October 9, 1895.

December 4, at 4.30 A.M. Patient had severe attack of abdominal pain; testicles retracted, right one into inguinal canal, and great annoyance from desire to micturate; pain from abdomen passes down into the glans penis; color of urine amber; specific gravity 1026; albumen only a trace; mucus, blood, and pus-cells.

4 P.M. Patient again examined by the attending surgeon; he still denies intoxication or injury; his abdomen is tympanitic and extremely tender.

December 5. Condition unchanged, except that pulse is more frequent; he still has to be catheterized; urine acid, coffee-colored; specific gravity 1020; trace of albumen.

It was now determined to make an exploratory laparotomy. Chloroform anæsthesia was used; an incision four inches long was made in the median line above the pubis; when the peritoneum was opened more than three pints of fluid escaped. The cavity was then explored; on the posterior wall of the bladder near the fundus was found a lacerated wound one and a half inches in length, extending obliquely from above downward and to the left; a catheter passed "per urethram" was felt through the wound. The abdominal incision was enlarged sufficiently to permit of the necessary manipulation; the posture being changed to that of Trendelenburg, and the rent was closed by nine catgut sutures. The peritoneal cavity was then thoroughly cleansed with hot water; a glass tube was placed in the lower angle of the wound, the remainder of which was closed with silkworm-gut sutures; a soft rubber catheter was retained in the bladder. When the patient was returned to the ward his pulse was 150, and very feeble; respiration 23, and entirely thoracic; every hour during the night the drainage-tube was kept clear by exhaustion with a syringe; ether, camphor, and stimulants were freely used.

December 6, 1 A.M. Patient had entirely recovered from the effects of the anæsthetic; his pulse 132, small, and compressible, and could only be maintained by hypodermic injections of camphorated ether; a fair amount of urine was passed through the catheter, but from this time on, and in spite of the most energetic stimulation, he gradually sank and died at 10 A.M.; every effort was made to procure an autopsy, but the officials did not succeed.

CASE II.—Reported by Dr. Ross,. W. S., aged twenty-one years; single; Ireland; driver of ice-wagon. Family history negative. Patient uses whiskey, and was drunk when accident occurred.

About 7 A.M., February 24, 1890, patient fell from his ice-wagon in such a way that both wheels are said to have passed over his loins. The right side was uppermost, and was much bruised. Since the accident he has passed no urine. When found, he was in a condition of partial stupor, and complained of pain across the abdomen.

He was brought to the hospital in an intoxicated condition; slept for two or three hours in the accident ward: then he began to complain of severe abdominal pain and constant desire to micturate. Brought to the ward, and at that time semipriapism noted.

A catheter was passed, and twenty-three ounces of bloody urine were drawn. Pain relieved by one-third grain morphine hypodermically.

Physical examination of abdomen at that time negative. At one o'clock abdominal distention noted with increase of abdominal pain. At 3 o'clock a catheter was passed, and four ounces of bloody urine withdrawn. Upon manipulation of end of catheter in the bladder it suddenly appeared to slip into another cavity, and was followed by the withdrawal of ten ounces of decidedly bloody fluid. Diagnosis of rupture of bladder made. Patient placed upon the operating table.

Operation 3.30 P.M.; finished 5.30 P.M.; chloroform ether narcosis. Every attention was paid to antiseptic detail; an incision was made in the median line, commencing three inches below the umbilicus and terminating about half an inch above the symphysis pubis. The incision was deepened until the peritoneum was reached; the muscles in the wound's lower angle were somewhat contused; the peritoneum was picked up with anatomical forceps and divided; from four to six ounces of fluid escaped when this was done; the index-finger was introduced into the abdominal opening, and immediately the rent in the bladder was recognized. A large flat sponge held back the intestines above, and with remarkable ease the ruptured organ was brought through the opening in the abdomen and exposed well to view. Before exposing it thus the fingers could be carried down through the interior of the bladder, and the sphincter vesicæ and neck of the bladder could be made out.

The tear was about two and three-quarters inches in length, its edges were rather ragged, and its position was in the fundus. Thirteen fine sutures passing through the visceral peritoneum and muscular wall were used in bringing the torn surfaces into apposition. An endeavor was made to avoid the mucous membrane in the sewing, but it was thought two sutures passed through the mucous membrane.

The upper part of the abdominal wound and the intestines were shut off by a large flat sponge, and the lower part of the wound and the region about the repaired bladder were flushed with hot water sterilized.

A large glass tube was placed in the lower angle of the wound, passing downward and forward. The margins of the wound were approximated with interrupted sutures of silkworm gut with intervening catgut sutures. An antiseptic absorbent dressing was applied.

Patient was next put in the lithotomy position, and a grooved sound passed into the bladder. The sound was given to an assistant, who also held the scrotum well forward, keeping the raphé exactly in the median line. The perineal region was made aseptic, and an incision was made down upon the staff's groove into the bladder. There was a very small amount of hæmorrhage. A large rubber tube was then passed into the crippled organ, and was held in place by a silk suture passed through the soft parts. The bladder was irrigated; tube surrounded with absorbent cotton.

February 25. Recovered from ether without vomiting, but had considerable pain during the night, quieted by use of morphine. During the night there was considerable bleeding from perineal wound. It continued about five hours, but was eventually checked by pressure.

A strip of gauze was inserted into the tube, and from time to time during the night was removed without disturbing the patient. Thus drainage was provided for.

Temperature went to 100.6°–99.6° F.; pulse 120; respiration 36. Patient almost free from pain. There is less distention.

February 26. Tympanites increased, and, later, vomiting added to his suffering; first the contents of his stomach, and later a yellowish-green matter thin as water. There was an interval of four hours (from 4 to 8 P.M., 25th) when there was no vomiting, then it reappeared; it was pronouncedly of the peritonitis type. Gastric lavage was commenced at 11 P.M., and one quart of thick, offensive, greenish matter was removed; the water used for the lavage was of a temperature of 102° F., and the operation was continued every four hours during the night. Large quantities of gas came out with each washing. Pulse 150; temperature 99° F.; respiration purely thoracic and 32. Lavage every two hours; matter less offensive and not so thick, but green.

After each wash, a half ounce of whiskey (hot) and the same quantity of water was put into the stomach through tubes, and two ounces of peptonized milk given.

February 27. Pulse 146; respirations 28; temperature ranges 99° to 102° F.

Patient was given an enema of one ounce of glycerin, one ounce of sulphate of magnesia, and six ounces of water, this was repeated in four hours, and was followed by a dark unformed movement.

Lavage continued up to 3.30 A.M. (27th), effecting a diminution in the tympanites and an amelioration of his other symptoms. Gas again, in large quantities, escaped through the tube at each washing. One dose of one ounce of whiskey (hot) and ten minims of tincture strophanthi were given through the tube.

February 28. There has been no vomiting during the past 24 hours; the abdominal distention has grown steadily greater; emaciation has been great and progressive; pulse rapid and failing; temperature range 100° to 102° F.

Patient bears the appearance of a man after weeks of wasting disease,—a marked contrast from his robust appearance on admission. There is mild delirium.

3 P.M. Extremities cold, cyanotic; Hippocratic countenance.

Death occurring February 28, at 6.31 P.M.

CASE III.—Reported by Dr. Francke. R. P., married; birthplace, United States; occupation, ice-man.

Previous history: Patient was treated in the hospital, during a few days in the month of July, this year, for cellulitis of arm. He developed symptoms of delirium tremens, and was transferred to Bellevue Hospital.

Present history: While unloading ice from a wagon, about 6 P.M., on August 13, he slipped and fell. A large piece of ice fell on top of him, striking him on the abdomen. He went to his home, and states that he felt no bad effects from his injury, until early on the morning of August 24, when he began to suffer from severe pain in the region of the epigastrium. On attempting to urinate, he passed one or two ounces of "blood." An ambulance was summoned, and he was taken to the hospital.

On admission: Temperature 98.2° F.; pulse 82; respiration 30.

Examination by visiting surgeon, 11.30 A.M. Condition fair; hypogastric and inguinal regions moderately distended, dull on percussion, the dulness fading out laterally and above; there was no such distinct tumor as is met with in distended bladder, and no bulging in the rectum; a silver catheter was passed, and evacuated a quantity of bloody urine.

Diagnosis: Rupture of bladder; intraperitoneal operation; ether narcosis.

The patient being placed in the Trendelenburg position, with the head towards the window, so that the rays of light might fall directly into the pelvis, an incision, three inches long, was made in the median line, directly above the pubes, until the bladder was exposed below the reflection of the peritoneum. It was opened on a sound, previously introduced, and temporary loops were introduced through the middle of the incision. These served to steady the organ and to draw it towards the surface. The opening gave exit to a very large amount of blood-clot and urine. A finger introduced passed readily through a large rent in the posterior surface of the bladder. The peritoneum was now opened, and the abdominal incision enlarged upward to within two inches of the umbilicus. In this situation, also, was found a large amount of blood-clot, bloody serum, and urine. The exact amount was difficult to estimate. A vertical wound was found in the posterior wall of the bladder, passing from fundus to base in the middle line, its length at least two inches, its edges ragged and bruised. A blunt hook passed through the incised wound in the anterior wall and out through the rent, served to draw the bladder to the surface. The place of this instrument was then taken by a loop of silk, passed through the upper angle of the rent, and supplemented by two other loops passed through the middle of the rent. These temporary loops served to draw the organ to the surface, facilitating, to a marked degree, the introduction of silk sutures passed through the peritoneal and muscular tunics, bringing everything into accurate apposition. The abdominal cavity was then cleaned of clots, serum, and urine by repeated copious irrigation with hot water; the toilet completed by drying as completely as possible, and the edges of the wound effectually secured by silkworm gut. This adjustment was made so as to permit the introduction of a drain into the cavity of the peritoneum, which lay along the line of sutures in the bladder, and a T-drain in the bladder, but with no possible communication and no danger of infection of the former from the secretions of the latter. Patient left the table in fairly good condition. He was sent to ward, the foot of the bed elevated, heat applied to surface of body.

After operation patient vomited a considerable quantity of dark-brown fluid. At 4 P.M. temperature had risen to 102.8° F.; pulse 132: respiration 46. Temperature continued to rise steadily, and at 8 P.M. was 104.2° F., when an alcohol bath was given. At 10 P.M. catheterized without result. At 11.30 P.M., pulse being very weak, he was given hypodermically strychnine sulphide one-thirtieth grain, camphor and ether twenty minims.

August 25, at 1 A.M. Temperature had risen to 104.6° F., and patient was restless. Died at 3.30 A.M.

*Autopsy.*—Dr. Tuttle. The rent in the bladder was found to measure two and three-quarters inches. The sutured wound was clean and apparently tightly closed. There was no effusion of urine or other fluid into the peritoneal cavity. The other abdominal viscera were normal, with the exception of the kidneys, which showed some evidence of nephritis.

*Remarks.*—I think it is a common impression with the general practitioner that ruptures of the bladder are always caused by violence; that such is the cause in the great majority of instances there can be no doubt, and that it also occurs most frequently in persons under the influence of alcohol is equally certain. Such a condition fills the bladder rapidly, and the sense of repletion is not recognized by the brain; but there are quite an array of cases in which there has been no history of trauma, cases in which the organ has given way under the combined influence of distention from within and muscular action from without. There are over fifty such cases on record due to strictures of the urethra or prostatic obstructions; in some cases to some inherent weakness of the bladder, tunicary hernia; supplementary pouches caused by protrusion of mucous membrane, through intervals in the muscular coat. In some cases the rupture has occurred through some part of the bladder that has been thinned by ulceration, tubercular or malignant, and I strongly suspect the accident that occurred in the first of those reported in this paper was due to such condition, the absence of trauma and the very obscure character of the earlier symptoms would appear to warrant such conclusion, and it was unfortunate that we were not able to obtain the post-mortem investigation that would have cleared up the doubt. At the same time I must express my opinion that it is not always prudent to place implicit confidence in the information given by the patient, when it conflicts with the evidence of one's own judgment. I well remember a man who was brought into the hospital, with slight or no symptoms of shock, but with a rapidly-increasing tumor in the region of the kidney, which was believed to be due to rupture of that organ, yet this patient in the presence of a contemplated operation denied intoxication and injury. A free opening in the loin, which evacuated a quart of stinking bloody urine, displayed to view a badly-ruptured kidney, and one month after he admitted that he had been engaged in a drunken fight.

If the accident occurs to a sober person, or to one only slightly inebriated, there will probably be a sense of something having given way, of intense pain in the lower abdomen, a sense of faintness, and disposition to vomit. Shock is generally a pronounced symptom, but there are many cases on record in which it was absent, some in which the patient walked one or more miles to obtain relief, and a few cases in which visits were made to the surgeon once and twice a day for several days preceding the fatal event.

Simultaneously with, or very soon after, the fatal explosion comes urgent desire and inability to pass urine; sometimes the patient may succeed in passing a few drops or ounces of bloody urine; a catheter introduced with ease cannot be rotated as in the distended bladder, and occasionally after removing a very small quantity of bloody urine may by some successful manœuvre be passed through the rent in the bladder into the cavity of the abdomen, and give issue to a still larger quantity of urine.

It will soon be noted that there is a more or less defined and fluctuating swelling in the hypogastrium; it does not have the definiteness of a distended bladder, but shades off laterally and above; it is exquisitely tender and dull on percussion. These conditions will soon be followed by those of septic peritonitis, the characteristic vomiting, elevation of temperature, frequent pulse, distended tympanitic abdomen, haggard, pinched expression of countenance, and where you have such an assemblage of symptoms, there can be but little difficulty in coming to a conclusion as to the nature of the case, but once in a while some of the phenomenon are wanting, and there may be reasonable doubt as to the true nature of the case. In some such conditions it has been considered proper to inject some sterilized or antiseptic fluid through the urethra. Of course, this ought to furnish decisive evidence by causing the formation of a circumscribed tumor in cases in which the bladder was intact, which disappears when the fluid is permitted to return, the amount of fluid recovered in this way equalling the quantity introduced. I regard the institution of this measure as of very doubtful utility, and not free from the danger of spreading the infection over a larger area than that already involved by the existing extravasation, and it also incurs the danger of breaking up such adhesions as do occasionally limit the effusion.

Ten years ago, Walter Rivington, surgeon to the London Hospital, gave to the profession a very careful study of "rupture of the urinary bladder," based on the records of more than 300 cases. In this are the reports of eight cases of reported recovery after intraperitoneal ruptures, of which he makes a very careful analysis, rejecting six, and leaving only two authenticated cases of recovery.

As far as the treatment of this very serious lesion is concerned, these records afford very little encouragement. It consisted in vigorous local and general depletion, the free use of opium, regular use of the catheter, perineal section, and in one case abdominal section, closure of the rent, cleansing of the cavity of the peritoneum, and closure of the abdominal wound.

Our present knowledge of the inevitable septic processes that follow such accidents, and our familiarity with the successful results that follow prompt and decisive action in kindred conditions menacing the integrity of the peritoneum, must influence our judgment and outline our treatment in the future, but to be successful the institution of such measures must follow immediately upon the accident; procrastination must be fatal. In the first case reported in this paper, in which we were handicapped by having to deal with a patient who denied intoxication and injury, operation was done on the fifth, and he succumbed on the sixth day. In the second case operation was done eight hours and thirty minutes after the accident, and he died on the fourth day. In the third case, a man saturated with alcohol, the accident occurred at six in the evening; the patient was brought to the hospital the following morning; the operation was done at 11.30 A.M., seventeen hours and a half after the injury, and he died on the second day. These facts do not prove that the procedures adopted were not those best adapted to meet the requirements, but that they were used when the septic processes had made such headway as to be beyond control.

In my operative treatment of the second case, I thought I had stumbled on an ideal method; the lower end of a four-inch median incision was deepened in its lower part until the bladder was opened for exploration; it gave an excellent view of the rent in the posterior wall, and when the peritoneum was freely opened a short, beaked sound introduced through the operation wound in the bladder and then through the rent, enabled my assistant to lift the latter into the abdominal wound and greatly facilitate its suture. It was designed to leave the bladder open for drainage and to close the abdominal wound, but the objection to this method is that in most, if not all, of these cases it is necessary to drain the peritoneum, and the opening of the two drains in such close proximity would be a dangerous source of infection.

My present convictions are that the proper course to pursue in all cases of intraperitoneal ruptures of the bladder will be to open the peritoneum, close the rent in the bladder securely by closely-applied silk sutures, to irrigate the abdominal cavity with hot sterilized water, only close the upper portion of incision in its walls, filling the lower end with a tamponnade of gauze passed to the bottom of the pelvis; to drain the bladder by means of a large flexible catheter passed through a perineal incision, and maintained there by any device that fulfils the indication.

As soon as the characteristic green vomiting occurs I would advise lavage, and immediately after emptying the stomach, the introduction through the tube of liberal doses of sulphate of magnesia, sufficiently frequent and large to ensure drainage of the peritoneum through the medium of the intestinal mucous membrane.

# CONTRIBUTION TO THE STUDY OF NEPHROLITHIASIS.

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TWO especially interesting operations for the relief of renal calculus, occurring in the practice of Professor A. C. Bernays, were my incentive to a review of the history of this operation, and an investigation of the newer revelations in the pathology of nephrolithiasis. I submit the fruits of my research with a report of the two cases mentioned.

Prior to these considerations, however, a proper terminology demands our attention, and it is of especial importance on account of existing confusion in the use of names applied to the operations for nephrolithiasis.

The word "nephrolithotomy" was first proposed by Professor James Israel, who applied it only to the operation of cutting into the *pelvis* of the kidney for stone, and it is so accepted by no less an authority than Professor Rosenstein in his great work on "Internal Medicine." But this word is capable of a second interpretation,—viz., to cut into the *kidney substance proper* for a stone located therein. To this it seems more applicable, and I shall so use it. "Pyelotomy" is the term first proposed by Professor Czerny for cutting into the pelvis for stone, and it is certainly a more intelligible name than nephrolithotomy, as applied by Israel, to the same procedure. I will go one step further and propose "pyelolithotomy" as the only term conveying full meaning when applied to the operation of cutting into the *pelvis* of the kidney for stone, in contradistinction to nephrolithotomy for stone in the kidney substance proper. Strictly limiting each term, pyelotomy is to be used with nephrotomy, as proposed by Czerny, for simple incision into the kidney, and not applied by him to any of the stone operations; nephrectomy, however, as the only name for complete excision of the organ, must be so applied.

I propose, then, as a complete nomenclature for the surgical treatment of nephrolithiasis, the terms nephrectomy, nephrolithotomy, and pyelolithotomy, calling those operations "primary" which are undertaken simply for the removal of a stone, as distinguished from the "secondary" ones necessitated by tissue changes consequent upon its presence.

Some sort of operative procedure for the relief of renal calculus has been known and practised since the days of Hippocrates, who is said to have advised a lumbar incision, probably in cases of renal or perirenal abscess caused by stone, as Hevin, Rayer, and Smith did later. It is supposed that Marchetti was the first (in 1696) to cut into the kidney in search of a stone.

In 1770, Hevin collected reports of thirteen operations for the removal of renal calculi. In none of these, however, is it certain that the kidney substance was really invaded, and not simply a renal abscess opened. Rayer persuaded Velpeau to do some such operation, and the same was done later by Bryant and Callender. Erlich's "Surgery," of 1815, asserts that he did a similar operation, making an incision over the left kidney, and, after much manipulation, bringing forth a branched stone of considerable size. This variety of surgery does not seem to have attracted much attention among the English until 1869, when Mr. Thomas Smith read a paper on the subject before the Medico-Chirurgical Society of London, and following the suggestions of that article Mr. Thornton operated in 1878. The foregoing seem all to have been secondary operations, as I have defined the word; while Mr. Henry Morris claims credit for the first primary lumbar stone operation, in which claim he is sustained by Kendal Franks, Heath, Treves, Thornton, and others. His operation, a successful one, was performed in October, 1880. This is disputed by E. Herczel, of Heidelberg, who says that Czerny first suggested a primary operation in 1880, and that E. Norris was the first one to carry it out in the same year. Since then the operation has been done by many surgeons, the earliest operators were Reginald Harrison, Lucas, Jordan Loyd, James Israel, and G. Simon, of Heidelberg.

Recent pathological investigations have shown that for the formation of renal calculi as of gall-stones two prime factors must co-operate,—viz., (1) stagnation and (2) infection. Stagnation is most often produced in one of the following ways: (1) Displacement of the kidney and consequent bending or twisting of the ureter; (2) pressure on the ureter; (3) atrophy of the muscular coat of the pelvic and ureteric walls, this last explaining in part the fact that stone is much more common in old than young adult life. Another reason for this is the resorption, in the aged, of bony tissue, and the setting free into the circulation of the very material needed to form calculi.

Infection (pyelonephritis) occurs as a result of one of three processes: (1) (descending) Infection from the circulation in septicæmic conditions. (2) (ascending) Infection from a focus lower in the urinary tract. (3) Transmission from neighboring organs by contiguity. The growth of colonies of bacteria in all directions is favored by stagnation, while epithelium shed as a result of the infective process furnishes a convenient nucleus. The frequency of infectious manifestations in the kidney during the diseases peculiar to childhood partly explains the fact that renal calculus is more common at this than at any other period of life. Accessory conditions to such formation are: (1) Excess of precipitable salts in the urine; (2) too acid or too alkaline a reaction, either of which lessens the solvent power of urine; (3) presence of any floating substance that might form a nucleus,—viz., albumen, a clot, mucus, a colony of bacteria, or desquamated epithelium, as above noted. In addition to the concretions of renal origin, it is a fact worthy of note that gall-stones have been found in the pelvis of the kidney as a result of perforation.

Etiologically speaking, we must not forget the greater prevalence of renal calculi in districts where "lime-water" is drunk and in the chalk countries. In the United States, east of the Mississippi, the affection is most common, in Ohio, Kentucky, Tennessee, North Carolina, Alabama, and Virginia.

Case I.—The patient, male, aged twenty-five years, of low stature, heavy set, dark complexion, by occupation is a saw-filer.

Family history: The father, an Englishman, is forty-eight year of age and living, has suffered for years with "gravel," and the digestive disturbance known as "water-brash." The mother, an Irish woman, forty-six years of age, has suffered much from digestive troubles, has borne nine children. Four of the nine children are living, of whom three have always enjoyed good health, except in early childhood, when the acute diseases peculiar to this age were experienced by all; of the other five two died of diphtheria in early childhood; a third in childhood, cause unknown; a fourth at seventeen, cause unknown; and the last at twenty-four, of undiagnosed kidney and liver trouble, when seven months pregnant. The element of heredity in nephrolithiasis is marked in this family. The father suffered with gravel, and a sister died from what seems to have been a kidney-disease.

The patient was born in Montreal and experienced the ordinary acute diseases of childhood. He gives a history of general digestive disturbance existing since the age of thirteen. At intervals from fourteen to twenty-one he experienced the peculiar sensation of "a marble rolling around in the left side," to put it in his own words. His first attack of renal colic was at twenty-two and in the right side (illustrating the interesting fact to which Thornton first called attention, that stone in one organ sometimes caused pain to be referred to the opposite side). The very first of these colicky attacks was so severe as to cause vomiting. They continued to occur spontaneously day or night, and with varying intensity for eight months, often as many as four or five in twenty-four hours; but he never, to his knowledge, passed gravel. Sometimes he could retained his urine for six hours, but again no more than a half hour. He was then free from pain for six months, when the left kidney was attacked for the first time, this attack lasting but a few days, then no more such trouble for nine months. In April, 1893, he contracted gonorrhœa, which did not cease causing him discomfort until May, 1894. In August, 1894, he incurred a so-called malarial attack, which lasted four months. Pain in the left kidney returned for a few days in January, 1894. In August and September he had pain in the left kidney every few days, after which he was free from it until late in December. About the middle of January, 1895, he noticed hæmaturia for the first time, and only once. Then two weeks later it returned and was constant for two or three days. During the next week his urine was clear, then bloody again for two days. Up to this time no pain had accompanied the hæmaturia. Early in February the blood appeared again and at the same time excessive pain in the left kidney and testicle. From this date until the operation the hæmaturia was intermittent, a few days of clear urine alternating with the same length of time in which blood was constant. Pain was continuous and excruciating until the middle of March, since which time the patient's existence has been fairly tolerable.

May 3, 1895, I examined the urine. A probable diagnosis of nephrolithiasis had been made by Dr. W. W. Graves. It was based on the clinical aspects of the case. The urine was smoky, almost opaque, and, upon settling, presented a heavy sediment.

There were revealed upon examination,—chemical and physical: color red; specific gravity 1028; reaction acid; albumen present (three tests); sugar none.

*Microscopical Examination.*—Calcium oxalate crystals; calcium carbonate; red blood cells; red blood-cell casts; polynuclear leucocytes; streptococci.

The oxalate crystals were most of them the brilliant refractive quadratic octohedra.

No effort was made to ascertain the kind of streptiform bacteria present. The red blood-corpuscles and casts of same together with the clinical history pointed to one of three conditions: tuberculosis of the kidney, malignancy or calculus, the presence of calcium oxalate crystals, making the last one by far the most probable diagnosis. Based on the above, surgical treatment was decided upon and the patient sent to Pius Hospital of this city.

May 9, at 10 A.M., the operation was performed. The patient was placed on the right side with a block under him. A five-inch incision was made parallel to the twelfth rib and one-half inch below it, with its middle point a little behind the axillary line. This incision is invariably used by Professor Bernays in operating on the kidney. The peritoneum was unusually high in this case and formed the floor of the wound. On pushing aside this membrane the fatty capsule of the kidney was exposed. This was quickly torn through and the organ itself completely laid bare. As nothing abnormal could be seen or felt, an exploratory puncture of the kidney substance was made, but still no stone detected. The post-mortem incision was now made through the capsule, the deeper kidney substance was separated by the finger-nail, thus avoiding excessive hæmorrhage, and the much-sought-for stone found firmly embedded in the pelvis, whence all efforts to dislodge it with a curette were fruitless. It was finally caught with a long tissue forceps and extracted after some manipulation. Oozing from the kidney substance was inconsiderable, but to insure perfect drainage a small rubber tube wrapped with gauze was left extending from the pelvis without the external wound, which in the rest of its extent was closed with interrupted silk sutures, none of any kind being used in the kidney. The entire operation required but twenty-six minutes for its completion.

The stone, one of the mulberry form, is covered with calcium oxalate crystals. Its weight is twenty-six and a quarter grammes. In shape it may be called irregularly pyramidal, its three greatest dimensions being nine-sixteenths, eight-sixteenths, and five-sixteenths inch respectively.

The patient made an uninterrupted recovery. Slight leakage of urine persisted until June 1, when the external wound closed perfectly. On the fourth day after the operation the urine cleared up, and, with the exception of a few slightly-tinged discharges, has remained so. When he left the hospital, June 6, I could discover in the urine neither red blood-corpuscles nor oxalate crystals, but there were many polynuclear leucocytes in evidence of a persistent pyelitis. Chemically were shown serum, albumen, and nucleo-albumen. If not perfectly well, this man has exchanged a miserable existence for one of perfect comfort and correspondingly good spirits.

Case II.—The patient, Mr. McA., presented himself for treatment in March. He is tall, sparely built, and walks with his body slightly bent to the left side. He is twenty years of age and comes of a healthy family. He has been a sufferer from colicky attacks in the left side since his eighth year. Sometimes as many as seven distinct paroxysms have occurred in a day. Several times these seizures have caused vomiting and nearly rendered him unconscious. They often come on while he is perfectly quiet, no kind of diet or regimen influencing them in the least.

Inspection of his body reveals nothing abnormal; no increase in size of the left kidney can be detected, but pressure over this organ is very painful. He passes his urine about every two hours, but sometimes sleeps six hours without doing so. The urine when fresh is of a clear amber color. After standing, a slight cloud appears. Specific gravity varies from 1012 to 1020. Albumen is always present.

Microscopical pus cells are seen. also envelope-crystals of calcium oxalate and red blood-corpuscles, but never enough of the last to warrant a microscopical diagnosis of hæmaturia. However, the patient states that at one time, while riding over a very rough road, his urine was red, and, at that time, it no doubt contained many more red corpuscles than these examinations revealed. A diagnosis of renal calculus was made and the patient sent to the Pius Hospital, where at 10 A.M., April 10, Professor Bernays performed the following operation:

An incision about five inches long was made parallel to the twelfth rib and about a half inch below it, extending from the sacro-lumbar muscle to the axillary line down to the kidney, and entirely extraperitoneally. After being enucleated from its fatty capsule the kidney was found entirely normal in size and appearance. No stone could be felt on most careful palpation of kidney and pelvis. Feeling certain of his diagnosis, Professor Bernays inserted the needle of an ordinary hypodermic syringe along the convexity of the kidney in the direction of its pyramids. After three or four unsuccessful attempts it struck a hard obstacle apparently in the substance of the kidney. Having thus located the stone he split the fibrous capsule of the kidney for half an inch and then bored his index-finger in the parenchyma, quite easily separating the tissue down to the stone. This was removed from its bed by a large Simon's curette.

There was very little hæmorrhage; the small lacerated wound in the kidney being soon closed by a blood-clot and requiring no suture. The external wound was closed by deep and superficial sutures except where a rubber drainage-tube was left reaching down to the point where the stone had been.

The wound healed entirely by first intention, not one drop of urine ever escaping. No pus ever appeared, and there never was any pain after the operation; but the urine continued bloody for four days, after which it gradually cleared up. The patient left the hospital on the twenty-first day.

The stone is two centimetres in its largest and one and a half in its shortest diameters, is flat, and only three-quarters centimetre in thickness. The entire surface is studded with calcium oxalate crystals, which refract light in a beautiful way.

From the literature of the subject at my command and these two cases, I draw the following conclusions:

(1) The transverse lumbar incision is preferable to any other.

(2) When reasonably sure of his diagnosis, although, as in Case I, palpation and puncture reveal nothing, the surgeon is justified in tearing open the secreting portion of the kidney, in the search for a stone, before giving it up as a case of mistaken diagnosis.

(3) In opposition to James Israel,[1] the use of the knife on kidney substance to get at a stone within is not to be recommended. Much preferable is Professor Bernays's method of simply cutting the capsule and pushing the finger bluntly through the tissues. The lacerated wound bleeds but little, and the torn walls readily approximate one another.

(4 (*a*) Nephrolithotomy is the proper operation in cases of nephrolithiasis, except in the conditions to be detailed under (*b*) and (*c*).

(*b*) Pyelolithotomy is to be done only when a stone is easily felt in the pelvis of the kidney.

(*c*) Nephrectomy is permissible only in those cases in which the secreting substance of the affected organ is almost completely destroyed and the opposite kidney known to be healthy, which can be accurately determined only by catheterization of the ureters, a procedure which in the male is by no means common. Against nephrectomy must be urged the fact, that the affected organ may be a *solitary* one,—*i.e.*, the possibility that there is only one kidney. If it has a companion, this second one is quite likely to be similarly affected.

(5) The extraperitoneal operation is decidedly preferable to that through the anterior abdominal parietes. The urine in nephrolithiasis always contains pathogenic bacteria, so that the reason for this choice is obvious.

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# SOME CONSIDERATIONS IN THE OPERATIVE TREATMENT OF FRACTURE OF THE PATELLA, WITH SPECIAL REFERENCE TO SUTURE MATERIAL AND THE USE OF SALT SOLUTION.

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THE operative treatment of fracture of the patella, either from choice, in simple cases, or from necessity in those which are compound, is perhaps a somewhat trite subject. The popularity of different methods rises and falls, and we are still apparently as far as ever from a set of rules acceptable to all surgeons. There are, however, some points connected with the strictly operative treatment which I think it will not be uninteresting to discuss in the light of some clinical experiences. The form of operative treatment which I wish to discuss is that applied to cases within from four to seven or eight days of the occurrence of the injury, and that which involves the more radical operative measures, not considering the methods employing hooks or subcutaneous suture, which can hardly be called operative methods in the sense in which I am using the term. Perhaps it will be as well to quote some cases first, and discuss their points of interest later. The cases which I am about to describe are all cases operated upon in Roosevelt Hospital, New York, and they represent *all* the cases of fracture of the patella subjected to the operative form of treatment from November, 1892, to November, 1893. They are not cases selected simply for the good result. Every case of the class under discussion has been described,—that is, all cases of recent fracture of the patella, either simple and having certain characteristics which I shall mention, or cases in which the fracture was compound. During the year mentioned only one case of recent fracture of the patella besides these which I am about to describe was subjected to ward treatment in Roosevelt Hospital. That case was treated with straps, and the result was moderately good.

CASE I.—Boy, aged fifteen years. Injury received by falling from the roof of a house four stories to the ground. Patient sustained a compound comminuted fracture of the right patella, and in addition a simple fracture of the right femur and of the left tibia and fibula. I operated the same evening (in August, 1893), and found that the patella had been shattered into six or eight irregular fragments. some of which were entirely free, while others were held together by ragged bands of aponeurosis. The *ligamentum patellæ* was torn from the lower part of the bone, taking a piece with it. The joint was full of blood-clot and fluid blood. I made the incision free and transverse; several of the loose fragments of bone were removed, all the fluid and coagulated blood cleared away, and the joint washed out with a six-tenths of one per cent. salt solution. The larger fragments were drilled and sutured with ordinary catgut, and the end of the *ligamentum patellæ* sutured with the same material to the reconstructed patella. The subsequent treatment was dressing on the third day to remove the rubber-tissue drains, and then fixation for about three weeks, then a change of dressing and the beginning of a small amount of lateral movement of the patella to guard against the formation of adhesions. At the end of six weeks the patella was freely movable laterally, and movements of flexion were begun. Improvement was uninterrupted, and in twelve weeks the boy was walking. Eighteen months after the injury the boy has an absolutely perfect knee-joint, and the evidence of previous fracture in his patella appreciable by palpation are practically nothing. There is absolutely no limitation of motion in the joint, and the movements of the patella are perfectly smooth.

CASE II.—H. D., male, aged twenty-five years; admitted, five days after injury, on December 16, 1892. Operation on eighth day from day of injury by Dr. McBurney. Fracture occurred in the common way by violent muscular action. When patient was admitted he had a right knee-joint very much distended with blood, which, of course, at that date must have been firmly coagulated; the whole region of the joint was much swollen and ecchymotic, and the exact size and shape of the fragments could not be made out by palpation.

The case was considered one not only eminently suitable for treatment by operation, but one actually requiring such treatment if a good result was to be obtained. The operation was done through the usual transverse incision, and the joint was found filled with large firm clot separating the fragments and filling the space between them. The lower fragment was much smaller than is observed in the average case, and its fractured surface faced directly forward, making apposition with the other fragment by any means except operative clearly impossible. The blood-clot was cleared away, and the joint carefully washed clean with the usual hot salt solution. The fragments were drilled and sutured with catgut, and the capsule of the joint sutured with the same material where it had been opened at the sides by the incision which had been made so as to give access to all parts of the joint. Folded rubber-tissue for drainage not going into the joint. Characteristic aseptic course.

January 12, wound is healed, and heavy dressing is changed for a lighter one. January 13, passive motion is begun *laterally* only. February 6, patient walks with a short splint. Flexion is begun and efforts repeated daily. February 26, patella freely movable, especially in lateral directions; union close and good. March 1, all splints have been dispensed with. March 13, the patient is discharged cured, with voluntary flexion to sixty degrees and solid union in the bone.

Case III.—F. H., male, aged twenty-eight years. Admitted December 24, 1892, and operated upon on seventh day from that time by Dr. McBurney. Usual transverse incision. The condition was found to be typical of fracture of the patella from muscular action. The lower fragment was bevelled and the joint entirely filled with firm clot. This was cleared away, and the joint washed out in the usual manner with sterile salt solution used hot. The fragments of patella were drawn together with catgut in the usual way, drill-holes first having been made in them for the passage of the sutures. The incision in the capsule of the joint at each side of the patella was also carefully closed by suture. The superficial portions of the wound were drained with folded rubber tissue, which was removed at the end of a few days. January 15, wound entirely healed. January 31, the patella is found to be movable on the condyles, and union between the fragments so far good.

Moderate massage has been employed for the past two weeks. February 6, good lateral motion is possible in the case of the patella, and movements of flexion are begun and employed daily. March 4, voluntary flexion to a right angle is now possible, and all splints are dispensed with. The patient was discharged cured a few days from this last date, with voluntary flexion to a right angle, smooth joint action, bony union, and no limp.

CASE IV.—J. H., male, aged thirty-two years. Patient admitted January 13, 1893, and operation done by Dr. McBurney the next day. This fracture was caused by direct violence, and in addition to the fracture there was a transverse wound over the patella one inch long. The fracture of the patella was also transverse, but not directly under the skin wound, with the leg extended. The line of fracture was straight and clean. There was no bevelling and no comminution. The incision was the usual transverse one. The joint was found full of blood-clot, and there was a good deal of subcutaneous extravasation all over the front of the joint. The fragments of patella were not very widely separated, but what space there was between them was full of blood-clot. The joint was cleared of clot and washed out thoroughly with hot-salt solution, as in the other cases, and the bony fragments were drilled and sutured with catgut in the usual way. In closing the superficial wound, folded rubber-tissue drains were used; and at each corner the folded tissue was placed so that its end lay in the joint. January 21, drains removed and wound found normal. At the end of the third week passive motion and massage were begun, but flexion was avoided at this early date. The patella, however, was moved moderately and increasingly from side to side. At the end of six weeks flexion was begun and slowly increased in extent. March 1, flexion is possible to sixty degrees, with smooth joint action. March 14, solid union between fragments has occurred, and is, without doubt, bony. Action of joint is normal, except that there is moderate limitation of flexion, which is slowly disappearing. Patient is discharged with a normal gait.

Of course, these cases which I have just described can have no *statistical* value for obvious reasons. I think, however, that they do possess an *illustrative* value, in showing the results of a certain line of treatment carried out in all four cases. As will be noticed, two of the cases occurred in the common way from muscular action, and in two the injury was sustained by direct violence. Before discussing the subject any further, I should like to mention briefly two cases closely allied to those under discussion, operated upon, one by Dr. McBurney and one by Dr. Hartley, through the courtesy of which gentlemen I am able to quote them. I refer to two cases of rupture of the quadriceps extensor tendon.

Case I.—T. K., male, aged fifty-three years. Admitted November 30, 1892, and operated upon on the fifth day from date of injury by Dr. McBurney. The injury was caused by a heavy body striking the tense tendon, with the knee in a position of moderate flexion. The tendon was found completely divided and the joint full of blood. The treatment was exactly similar to that in the cases of fracture, and the course uninterrupted to recovery.

January 8, passive movement begun with lateral movement of the patella, and flexion to a very slight degree. February 1, the joint is almost absolutely normal. February 5, the patient is discharged with an absolutely perfect joint, which is entirely under his control. This patient is further remarkable for the fact that eighteen months after his injury he was unfortunate enough, while doing the same kind of work, to sustain an exactly similar injury to the tendon of the other leg. Exactly the same treatment was resorted to with the same excellent final result.

Case II.—T. P., male, aged forty-four years. Admitted June 9, 1893, and operated upon next day by Dr. Hartley. The right quadriceps tendon was ruptured by a severe blow while the tendon was tense. The joint presented the usual amount of distention with blood, but the divided ends of the tendon were somewhat more ragged than in the other case. The joint and tendon were treated as in the previous case, and the subsequent course was the same. I might add that the sutures at the patellar end of the torn tendon in each case were passed on a drill and included the edge of the bone. The ultimate result in this case was excellent and the patient was lost sight of in a few months.

I have quoted these additional cases to further illustrate certain facts which I consider of importance in connection with the subject of fracture of the patella, believing that, from the similarity of the conditions after the injuries in question, such cases are sufficiently *apropos*.

Suppose, now, that we have a case of fracture of the patella of the ordinary kind, we find ourselves called upon to decide, first, whether, in this individual case, the operative form of treatment will give a better result than one of the other forms of treatment in which apparatus or splints are used; second, when the operation shall be done; and third, the plan of operation with its details.

If we were absolutely infallible in our operative technique, and if the undergoing of an operation did not involve a certain indeterminate amount of risk to the patient, probably all cases of fracture of the patella would end in better results if treated by operation with accurate approximation of the fragments than if treated by any other means.

But, unfortunately, such a happy state of affairs does not exist, and we are compelled to select cases, each of us, according to his judgment and experience. Perhaps the first condition which strikes one who has seen many cases of fracture of the patella is the varying amount of subcutaneous and intra-articular effusion of blood during the first few hours after the injury, this, of course, depending largely on the amount of laceration of soft parts and the size and distribution of the torn vessels. This extravasation of blood is, of course, of great importance in deciding whether to recommend operative treatment or not. For if, at the end of say twenty-four hours, the joint is full of such blood, and the tissues in its neighborhood are infiltrated and ecchymotic, making accurate palpation or diagnosis impossible, a much better result will be got if the joint is opened, cleared of its blood-clot, and the fragments accurately opposed,—bony surface to bony surface. The degree of such conditions necessary to be present to impel a surgeon to operate will, of course, depend on his experience and opportunities for carrying out aseptic technique. There are, of course, cases of fracture of the patella in which the conditions are so simple and the opportunities for accurate palpation so good, that even the most enthusiastic operator would probably not advise treatment by operation, but these are not *average* cases, and just as distinctly demand non-interference as cases like those of the first class require treatment by operation, if we wish to secure an approximately perfect result. It has been urged as an argument against early operation that the tissues in and around a knee-joint, in cases of fracture of the patella, have their power of resisting septic invasion lowered by the traumatism to which they have been subjected, and the local circulatory disturbances caused by the extravasation of blood with the changes in this blood consequent upon its alteration and absorption. The statement is, no doubt, true from a pathological point of view, but if we are really aseptic we need not fear this condition; if we cannot be aseptic we should not open the knee-joint under any circumstances. There are no degrees of asepsis. A good deal also depends on a patient's willingness to undergo an operation, and whether he is intelligent enough to understand the situation when we place it before him in its different phases. However, I leave the question as to what cases demand operation with only the general statement that they are those with a considerable amount of effusion of blood into the joint or with very marked bevelling of the fragments, or both, among cases of simple fracture, and all cases of compound fracture.

The choice of a suture material in the cases under discussion is a subject about which there has been a good deal of controversy, with apparently very little definite result as far as getting any general agreement as to what is most suitable from every point of view. The possible materials are practically three,—catgut, silk, and silver wire. No one probably would deny the great desirability of an absorbable suture, provided there could be a reasonable guarantee of its sterility, strength, and ability to last long enough in the tissues to permit a certain amount of union between the opposed surfaces.

Silk and silver wire can without question be easily made sterile, and each is very strong. However, the question of the comparative *ease* or *difficulty* of sterilization of suture material is one which, in the present state of surgical knowledge, we should not allow to trouble us. If a suture material can be sterilized, and is useful, we must sterilize it. Because it is more difficult in the case of catgut than in that of silk to attain perfect safety in sterilization, it is not necessary to give up catgut, if catgut is otherwise a better suture material than silk. We should see to it that our catgut *is* sterile. Many good results have unquestionably been obtained by the use of silk or wire, but most surgeons can probably recall cases returning after weeks or months with a small sinus leading to a suture in the patella, which refuses to heal, and requires removal of the offending material before healing can be obtained. This is especially apt to be the case after the use of wire. Furthermore, there may be a carious process started in the neighborhood of the suture which will require one or more scraping operations before healing occurs. The possibility of such occurrences in the use of non-absorbable materials indicates to me a wrong *principle* in carrying out the operation, for the defective results do not depend on an error of judgment or technique, but upon qualities inherent in the materials we use,—*i.e.*, their non-absorbability and consequent power to cause irritation. The idea that catgut is not strong enough, and will not last a sufficient time in the tissues, is, I believe, a mistaken one. The fact that we are dealing with this bone, the patella, and not with a soft tissue, need not, I think, make any difference in our choice of suture material. In ordinary cases of tendon suture we use catgut, and the proportionate strain on the suture is no greater in the large quadriceps tendon than in the small one where we must use smaller material. Very few surgeons would put a wire suture into a ruptured quadriceps tendon, very many would suture a broken patella with that material, yet the amount of tension which the sutures will be compelled to sustain is the same, and catgut in one place should be as safe as in the other, for the character of the newly-formed or forming tissue between the divided ends of such a tendon and between the bony fragments is certainly, as far as its tensile strength is concerned, the same during the first four or five days. If catgut sutures will not hold a fractured patella long enough to prevent separation of the fragments, they should not be trusted to hold a divided quadriceps tendon, something which I have seen such sutures do a number of times perfectly. The use of silk is open to the same objections as the use of wire, but in a lesser degree. When we have an unfortunate result with the use of catgut, the trouble is usually an error of technique, and an avoidable error. Admitting that catgut prepared in the ordinary way is absorbed in about four days, or at least so softened as to retain little strength, a carefully-applied dressing of sufficient rigidity, and the usual care in preventing muscular exertion, especially during subsequent dressings, may relieve us of the fear that the fragments will be pulled apart. The danger from an involuntary spasmodic muscular contraction is certain to disappear at the end of forty-eight hours or so, and after that the patient does not run the risk of himself tearing the fragments apart under a good dressing, if he is conscious and sensible. In all cases of suture of the patella after fracture, rupture of the quadriceps tendon, and division of other tendons by any means, which have occurred in Roosevelt Hospital in recent years, catgut sutures have been used, and their use has not been regretted on account of too early giving way of the material.

Let us now turn from suture material and consider briefly the subject of the employment of different solutions in the knee-joint during operations. If from any cause the vitality of the endothelial cells of the synovial membrane or its lymphatic vessels is interfered with, their power of performing their proper function is lost, and they may be killed and desquamate. When this process of desquamation, whether due to chemical irritation or inflammatory action, occurs, we see in the synovial membrane involved a process analogous to certain forms of peritonitis. If the irritation is slight, the cells are reformed and there is *restitutio ad integrum;* if the irritation is severe, we have a process similar to that seen in peritonitis with the formation of fibrous adhesions, consisting, of course, of connective tissue. It is these adhesions which are responsible for many cases of complete or partial "fibrous" ankylosis. When a fracture of the patella occurs, we have a joint at once more or less filled with blood, which must, in an aseptic state of affairs, undergo absorption or organization into connective tissue, or a combination of the two processes.

For the process of absorption to take place promptly and thoroughly, we must have normal functionating endothelium and lymphatic vessels, since an important part of the function of such endothelium and the lymphatic vessels of which it is an important part is the regulation of the amount of fluid in a joint, the removal of an excess or the supply of a deficiency. Now such a joint is opened by operation and is treated in one of several ways after being cleared of its blood-clots: it is washed out with some warm antiseptic solution; it is treated in the same way with distilled water or sterile .6-per-cent. salt solution, or an attempt is made to do a dry aseptic operation. Let us consider briefly these methods. When we treat the living animal cell, for example, the red or white blood-cells, with certain chemical substances or *distilled water*, and examine them with the microscope, certain well-known changes are seen which indicate that life and function for the protoplasm of these cells are impossible in the presence of such substances, among which, as indicated, is distilled water. Now what is true in this regard of the blood-cells is true of other animal cells, and consequently of those delicate endothelial plates lining the joints, peritoneum, pleuræ, etc. Therefore, when we subject these cells to a process which lowers their vitality, interferes with their function, or kills them, we *may* open the way for easy bacterial invasion and septic absorption, and *do* diminish the prospects of getting a joint without adhesions. It appears to me that the injurious effects of chemical antiseptics and of distilled water depend largely on two things,—an actual chemical destructive action and a difference in osmotic qualities between the interior of the cells and the surrounding fluid. Doubts might be expressed as to the prime importance of integrity in the endothelial layer, but I think that too much importance cannot be attached to efforts to preserve this layer from all injury and irritation. Of course, the use of the stronger antiseptic solutions in joint operations has long been discountenanced, except in the presence of septic processes, and we need not consider such use now. But the use of any antiseptic solution is a disadvantage in a clean joint, for it, as I have tried to show, injures the endothelium, and so may interfere with the excellence of the result, and, furthermore, its use in a clean joint is a confession of lack of confidence in our asepsis. The use of sterile distilled water is open to the same objections as the use of antiseptics and for the same reasons, though perhaps in a less degree. An aseptic operation done without the introduction of any fluids into the wound is a practical impossibility. We speak of a dry operation, meaning one in which no fluids are intentionally introduced into the wound, and one in which everything used in the operation is sterilized dry. But we cannot sterilize our hands dry, and, moreover, a field of operation exposed for a considerable time to the air, and dried from time to time with sterile gauze or sponges, runs a certain amount of risk from dust which may be present in the air. Furthermore, damp gauze or sponge is more effectual in removing blood than the same materials used dry. When we operate by the salt solution plan, I think we do so under the most favorable circumstances for securing an immediate and remote good result. In sterile .6-per-cent. sodium chloride solution we have a preparation which very nearly approaches the serum of the blood in its chemical and physical properties. It does not injure the animal cell in any way, can be made easily in large quantity, and sterilized by filtering and boiling. If an open joint is washed out with such a solution, the advantages are almost too obvious for comment. Even in the presence of a certain number of bacteria the use of such a bland solution would allow the endothelial cells and the small lymphatic vessels to combat their bad effects much more easily than if an antiseptic irritating solution were used.

In a recent contribution to the subject, Dr. McBurney[1] has shown what excellent results have been accomplished by the use of salt solution in cases of general septic peritonitis, cases in which results have been almost without exception fatal with other forms of treatment. He attaches very great importance to the use of salt solution on account of its non-irritating qualities. In conclusion, I believe that in cases of fracture of the patella treated by operations we will get the best results by using catgut sutures, washing the joint clean with physiological saline solution, and employing early passive movements and massage,—that is after the third week ordinarily. It is needless to emphasize the importance of *asepsis.*

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[1] New York Medical Journal, 1895, Vol. XLVII, No. 13

# A FURTHER CASE OF REMOVAL OF THE UPPER EXTREMITY TOGETHER WITH THE SCAPULA AND CLAVICLE.

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FOUR years ago I reported a case of removal of the entire upper extremity for osteo-sarcoma originating in the upper extremity of the humerus and extending to the tissues of the shoulder-joint.

The patient was a slight, anæmic young woman nineteen years of age. She gained rapidly in weight and strength after the operation and has remained in perfect health ever since, supporting herself well by retouching photographs with her left hand. She is now a beautiful, robust woman, married since about one year.

My second case, a Swedish laborer, forty-six years of age, was kindly referred to me by Dr. Blackman, of Geneva, Ill., about the last of April, 1894. He had at this time two hard, slightly nodulated tumors in the region of the supraspinatus muscle and at the end of the clavicle respectively; the former being one and a half inches in diameter and two and a half inches long, the latter about an inch in every diameter.

The tumors had given rise to no pain and had been discovered accidentally about two months before. In the mean time they had increased considerably in size.

I advised the immediate removal of the growths. The patient returned to his home and did not reappear until May 30, 1894.

He was in a severely intoxicated condition, so I postponed the operation for two days, limited him to a liquid diet, administered two ounces of castor oil twice in order to assist in the elimination of waste products, and gave him an abundance of water to drink for the same purpose.

The tumor had nearly doubled in size during these five weeks, which still further confirmed my diagnosis of sarcoma. The patient had always been thin, and of late he had become very anæmic, but his general condition indicated that he was a man of considerable endurance.

He had worked for years as a section hand repairing the road-bed and replacing worn-out rails on a railroad line. He was out-of doors constantly, without regard to weather, shovelling sand and gravel and carrying heavy steel rails. He supposed the latter part of his occupation to have caused the growths, although he could not remember of having been injured at any time. His health had always been good and he has a large family of healthy children. Occasionally he had taken whiskey to excess, but beyond this he was a man of good habits. On June 1, 1894, I proceeded to operate, the patient being anæsthetized with chloroform, ether being administered during the progress of the operation after complete narcosis had been established.

In order to be more positive concerning the diagnosis an incision was made into the larger tumor, showing it to be an enchondro-sarcoma, which had undergone colloid degeneration at several points.

This diagnosis was later confirmed by Dr. E. R. LeCount, pathologist at Rush Medical College, whose report I shall append to this paper.

It is a well-known fact that sarcomata originating in the humerus, scapula, or clavicle in the vicinity of the shoulder-joint are certain to recur unless all of these structures are removed. The indications were consequently unmistakable in this case.

The prognosis was relatively favorable because of the considerable distance between the tumors and the remaining tissues of the body after the completion of the operation.

With the aid of the excellent staff of assistants at the Augustana Hospital, and Dr. Frank Jay, who had assisted me at the previous operation, I was enabled to complete the entire task in less than three-quarters of an hour from the first incision until the completion of the dressing.

I again followed the steps laid down by Paul Berger almost exactly.

An incision was made over the clavicle, the periosteum reflected, a broad, blunt instrument inserted between the periosteum and the clavicle at the junction of the internal and middle third. One blade of a pair of bone-cutting forceps was inserted between the clavicle and the retractor, and the former was easily severed.

The outer portion of the clavicle was now elevated, the blunt instrument being left in place to support the periosteum and the underlying vessels. The subclavian artery could now be felt pulsating underneath the periosteum, and lifting the latter together with the subclavian muscle the dilated vein was plainly exposed at a point directly in front of the middle scalenus muscle. The brachial plexus was easily separated above by means of blunt dissection with the finger.

A catgut ligature was now passed around the artery and vein by means of fine blunt hæmostatic forceps. A silkworm-gut ligature, which had been rendered perfectly soft and pliable by immersion in hot water, was passed around the vessels in the same manner. at a point a quarter of an inch above the catgut ligature. After tying both carefully, forceps were applied to the vessels an inch below and the latter severed between forceps and ligature. Now the flaps were formed by carrying the incision forward and downward to the middle of the axilla from the outer end of the original incision. A second incision was carried backward over the outer third of the scapula and downward to meet the anterior incision in the axillary space. The skin-flaps were dissected up rapidly, and then the soft tissues were severed rapidly first anteriorly and then posteriorly along the surfaces of the ribs, all bleeding vessels being caught instantly with hæmostatic forceps.

There was almost no blood lost during the operation. A pad of moist sterilized gauze was placed underneath the entire surface of the flaps to prevent oozing while the wound was being sutured, when this was almost completed the gauze was withdrawn and pressure was made over the flaps by means of pads for the same purpose.

A rubber drain was inserted through an opening made in the posterior flap and a second one through the lower angle of the wound.

The wound was dressed on the fourth day, when the drains were withdrawn, and again on the seventh day, when the stitches were removed. It had healed primarily throughout except at two points half an inch in diameter which had become necrotic, probably from pressure. The patient was in an almost perfectly normal condition throughout the recovery. He insisted upon being up and dressed after the fifth day. He was kept at the hospital for four weeks after his operation for fear of having some injury occur to him, especially on account of his convivial habits. He is still (September 1, 1895) free from a recurrence and is in better health generally than for years before his operation, probably because he has abandoned strong drink and has secured lighter labor, being now a watchman at a railroad crossing.

In a considerable number of amputations near the shoulder or hip I have noticed that the patient is comparatively little shocked when the large nerves are severed with a sharp knife or catlin, but very severely when they are cut with scissors. Consequently, I have been careful in this instance to use the former instrument, and, it seems to me, with benefit to my patient.

In my former case I ligated with silk, and was annoyed several months later by having the ligature come to the surface, consequently, I used catgut in this instance, and, in order to be doubly sure, applied a second ligature of silkworm gut, which was left long so as to be withdrawn in case the end of the vessel became necrotic beyond the ligature, a condition mentioned by several operators. This condition did not occur in this instance, hence the ligature was simply cut short after the wound had completely healed.

Outside of the danger from septic infection, which can, of course, be practically eliminated in all well-regulated hospitals, the danger in this operation comes from hæmorrhage or shock.

Following the clear-cut directions laid down by Paul Berger, and described above, hæmorrhage can be controlled with comparative ease if the operator is not too meddlesome.

Making the section of the clavicle after reflecting the periosteum, one is not at all likely to injure the underlying vessels.

The brachial plexus can be separated from the blood-vessels with safety. Having done this, it is much wiser to apply the first ligature around both artery and vein and enough of the surrounding tissue to be entirely out of danger of wounding the vein than to attempt to ligate the vessels separately. It is not difficult to separate the vessels from the underlying tissues by blunt dissection, permitting the passage of the ligature with blunt forceps or with an aneurism-needle.

Later each vessel can easily be ligated separately.

This plan helps to avoid two dangers,—viz., injury to the vein, which may give rise to either hæmorrhage or air-embolism, and shock caused by an unnecessarily prolonged operation.

All operators, with whose views I am familiar from their writings, agree that the operation is indicated in all cases in which sarcoma involves the soft tissues of the shoulder-joint or the clavicle or scapula or humerus near the shoulder.

With the great tendency to recurrence after amputation for sarcoma of any portion of the humerus, it would seem best to perform this very radical operation even in cases suffering from sarcoma of the lower part of this bone.

The following report regarding the gross and microscopic appearance of the growths was submitted by Dr. E. R. LeCount, pathologist at Rush Medical College.

"*Macroscopic.*—There are two masses of tumor growth:

(*a*) The larger measures 6.5 x 5. x 4 centimetres, is situated below the clavicle, internal to the head of the humerus. It replaces the upper portion of the subscapularis muscle and that portion of the serratus magnus which is attached to the scapula. It is attached by a small band of tumor tissue to the outer end of the clavicle, which is eroded to a distance of 1.5 centimetres from its outer articular end. Attached to the outer end of the clavicle and continuous with the main mass by a small band of tumor tissue is a fine, uniformly pinkish-red, vascular, slightly nodular growth, about two centimetres in its longest diameter.

(*b*) The smaller mass, about two-thirds the size of the larger, lies directly upon the outer third of the clavicle, replaces the supraspinatus muscle, and is attached to the outer portion of the superior surface of the spine of the scapula.

These two growths are not connected by distinct tumor tissue. They are not well encapsulated, nodular externally, firm, uniform in color, cutting with a grating sensation, and presenting on section areas which are not unlike cancellated bone. The largest of these areas measures two centimetres in diameter. The remaining surface is cartilaginous in appearance.

*Microscopical.*—Sections were examined from portions of the tumor which presented the most varying appearances to the naked eye, bony areas excepted, hardened in alcohol, embedded in celloidin, stained in hæmatoxylin and eosin.

In all sections cartilage cells were found. In certain areas matrix tissue, homogeneous, granular, staining poorly, was much in excess of cellular elements, and this was the prevalent structure. Other areas showed cartilage cells in excess of matrix substance, these at times showing a slight tendency towards an arrangement in rows. Cartilage cells with indistinct nuclear figures, occurring as many as four in a single capsule, were not uncommon. Areas of hæmorrhage were found, as well as areas of pronounced leucocytic invasion.

Around blood-vessels cartilage cells were much in excess of the matrix substance.

In sections from the small growth attached to the outer end of the clavicle were many small round cells with a single relatively large-sized nucleus, as well as polynuclear leucocytes.''

This subject has been discussed very fully, especially during the past eight years, in a large number of papers, and in an exhaustive treatise by Paul Berger. Besides the latter work, the papers by Professor G. Adelmann and T. F. Chavasse seem to me of the greatest value. These authors have tabulated the literature on this subject up to 1888, hence I will enumerate only those articles which are of a later date so far as I have been able to collect them.

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# OPERATIVE TREATMENT OF ANEURISMS OF THE THIRD PORTION OF THE SUBCLAVIAN ARTERY.[1]

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(Concluded from Page 505.)

## Recurrent Aneurisms of the Third Portion of the Right Subclavian.

We could find only two cases of recurrent aneurisms of the third portion of the right subclavian, one of Andrew W. Smyth and one of Mitchell Banks.

In Dr. Smyth's case the aneurism returned after ten years.

After the patient was discharged cured, there was still, and there remained, a small, soft, slightly pulsating tumor.

The patient, finding no work at his ordinary trade of ship-steward, took to house-painting, using his right hand, which developed the circulation of the limb and caused the return of the aneurism.

The sac, which threatened to burst, was opened with the hope of plugging the end of the bleeding artery, but the hæmorrhage was so fearful that nothing could be attempted but a hasty general plugging of the sac with a compressing bandage over it; the patient barely escaped death on the table. He died in forty-eight hours.[109]

Thus, through the thoughtlessness and ignorance of the poor victim, one of the most brilliant surgical feats of modern times was annihilated.

The case of Mitchell Banks was in a man aged fifty; first, ligature of the innominate with the strictest antiseptic precautions; the bifurcation of the innominate quite half an inch lower than it ought normally to be caused difficulty in getting the aneurismal needle around the vessel; this had to be accomplished solely by feeling, as the artery lay too deep to use anything that could aid the operation; silk thread was first introduced and used to pass a stout kangaroo ligature: three knots were placed upon it; amount of force applied was only what was thought necessary to occlude the artery, but not to damage the coats; the operator was satisfied he had made a thorough and satisfactory ligation of the artery; the aneurism ceased to pulsate; after about two minutes a certain amount of pulsation returned in the aneurism; application of a kangaroo ligature around the common carotid; pulsation became again practically imperceptible; feeble pulsations returned the same night; marked pulsations three days later; practically there was no suppuration.

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[1] Read at the meeting of the Louisiana State Medical Society, May, 1895.

On the twentieth day the aneurism was quite as soft and the thrill as obvious as before; rapid increase of aneurism. Sixty-seven days after first operation the subclavian was ligated, as to go down through the cicatrix in search of the innominate, with a view of tying it a second time, seemed impossible; there was just room enough on the inner side of the tumor to reach the artery at the junction of the jugular vein with the subclavian vein; the matting together of the parts, as a result of the first operation, was such that it became almost impossible to know what one was dealing with; an unpleasant accident occurred; tearing of a small branch which was followed by a hissing sound indicating penetration of air, but patient showed no bad effects; the pulsation of the artery guided the search for it; very slowly, after an infinity of picking and tearing, the artery was exposed about half an inch from the aneurism; artery obviously thinned and dilated; passage of double catgut ligatures which were tied separately; no injury of walls; aneurism at once became still.

Mitchell Banks remarks pathetically, "A very few lines suffice to describe this operation, but it took more than an hour to perform it, while the difficulty, danger, and anxiety that attended it are almost impossible to describe. Owing to the fact that the parts had already been interfered with, there was a good deal of hardened and cicatricial tissue present. Compared with this the performance of tying the innominate was a mere surgical amusement."

On thirty-first day frequent hæmorrhage through a sinus; death on thirty-seventh day.[110]

The cause of failure in the case of ligature of the innominate may be due to the too rapid absorption of the kangaroo tendon; two or three ligatures should be used in the future; in the case of the ligation of the subclavian the thinned walls and dilated condition of the vessel, indicating disease, were surely the cause of the failure.

The evident cause of the return of the aneurism in the first case, as shown by the history, was the too free use of the upper extremity which developed the collateral circulation.

The preventive treatment therefore consists in causing the patients to change their occupation for one which does not require any exercise of the affected limb.

The most probable trouble now in future seems to be not hæmorrhage but a return and growth of the aneurism, through repatency or through the large collateral branches.

Banks's case above is an instance of the former, with its remedy, difficulties, and dangers. (B. and E.)

At the time that Dr. Smyth's patient returned to the hospital, ten years after his discharge as cured, with a tumor as large as ever, if not larger, Dr. Smyth and the writer studied closely the surgically accessible branches that might return the blood into the aneurism. We settled upon the internal mammary and it was ligated, but without any manifest effect.

The autopsy, made by the writer, showed that the return was due to the anastomoses of the perforating aortic intercostals with the branches of the subscapular through which the blood flowed freely through the axillary into the sac.

We had thought of these anastomoses as being the principal channels through which the upper extremity was nourished, but it never entered our minds that there was also an upward or retrograde current running back towards the heart.

That portion of the axillary artery extending from the origin of the subscapular to the aneurism was carrying a double current,—that is, a to-and-fro current. It may be better understood by saying a systolic retrograde current to the aneurism and a diastolic direct current to the arm.[111]

Dr. Smyth says, "I noticed during the dissection of the body that the elevation of the arm to a right angle with the body changed the direction of the trunk of the subscapular artery and would have reversed the circulation."

With the arm elevated the retrograde current from the subscapular would have gone directly to the arm, a retrograde current would have supplied the aneurism.

This simple experiment would not only have revealed the source of the circulation, but would have also shown an easy way to lessen the circulation in the aneurism.[112]

In cases of recurrent aneurisms when the vertebral has not been ligated, this artery, being the largest collateral branch, should be ligated.

Should the pulsations continue, or should they return, the axillary artery itself should be ligated between the sac and the subscapular artery, especially if compression of the artery stops the pulsation.

Dr. Smyth remarks in his account of the case, "Dr. Souchon concluded his report by saying that instead of ligating the internal mammary it was the axillary that should have been ligated, between the sac and subscapular, but this would have been followed by secondary hemorrhage."[113] But this argument would not hold good now with asepsis, etc. Besides, by actual measurement the distance between the origin of the subscapular and the sac was fully three inches.

Dr. Smyth says that the only safe ligature would have been that of the subscapular.[114] But this ought surely to interfere seriously with the nutrition of the upper extremity and cause gangrene of the limb.

Should the above means fail under strict asepsis, then the suggestions of Sabine, Markoe, Wyeth, Thompson, etc., should be considered, always with thorough asepsis.

## Aneurisms of the Third Portion of the Left Subclavian Artery.

The aneurisms of the left side are not as frequent; out of 120 cases, thirty-five were on the left, about 20 per cent., and eighty-five on the right side, about 80 per cent. (Poland).

*Traumatic Aneurisms of the Left Side.*—There are seventeen cases of traumatic aneurisms of the left side, by Dupuytren, Sawinkoff, Gibbs, Auchincloss, Majesté-Lallemand, Pereira, Earle, Warren, Manec, Mott, T. G. Morton, Madden, Marchesano, McKinnon, Michel, O'Reilly, Parke.

I.—1819. Dupuytren. Left traumatic subclavio-axillary aneurism; seven years previous to operation patient received punctured wound in left shoulder from behind; hæmorrhage; two months later the aneurism appeared, which, seven years later, had reached the size of a child's head; ligation of *second* portion of the subclavian; three years after ligature the aneurismal tumor was the seat of an abscess, which was opened, and recovery took place.[115]

II.—1823. Sawinkoff. Left traumatic subclavio-axillary aneurism; cause not mentioned; ligation of third portion; cure.[116]

III.—1823. H. L. Gibbs. Left traumatic subclavio-axillary aneurism; struck with a rope; ligature of third portion; cured.[117]

IV.—1833. Auchincloss. Left traumatic subclavio-axillary aneurism; ligature of second portion; died with cerebral symptoms, comatose; serous effusion beneath arachnoid; brain slightly softened; purulent infiltration in the region of the wound.[118]

V.—1834. Majesté-Lallemand. Left traumatic aneurism; due to wound of axillary artery, with excessive effusion of blood invading the supraclavicular region; ligation between the scalenes; the operative wound was at least three inches deep before the artery could be reached.[119]

VI.—1835. J. J. Pereira. Left traumatic aneurism of axillary artery, extending considerably into the supraclavicular region; the artery was deeply seated, and was ligated close to the outer border of the anterior scalene; cured.[120]

VII.—1835. Earle. Left traumatic subclavio-axillary aneurism; ligature of the third portion; cured.[121]

VIII.—1844. J. C. Warren. Left traumatic aneurism of subclavian artery due to rupture of the artery, caused by extension in reducing a dislocation of the shoulder; an abscess formed and upon its discharge hæmorrhage followed; there was great swelling in the supraclavicular region; the wound, to ligate the subclavian artery, was very deep and dark; no artery could be seen or felt at the bottom; the anterior scalene was divided; the pleura was perforated; finally, the artery was successfully ligated; later, secondary hæmorrhage occurred through the operative wound, but was easily controlled by plugging; cured.[122]

IX.—1848. Manec. Left traumatic subclavian aneurism; shot-wound; ligature of third portion; during operation external jugular vein was cut and air entered veins; cured.[123]

X.—1850. V. Mott. Fall of cask on shoulder; left traumatic subclavio-axillary aneurism; tumor situated below and under,—*i.e.*, behind clavicle; ligature of third portion; cured.[124a]

XI.—1866. Thomas George Morton. Left traumatic high axillary aneurism requiring ligation of the subclavian in the second portion; forty-three days after operation suppuration of sac; a bundle of nerves from brachial plexus sloughed away; gangrene of limb; frightful hæmorrhage; ligature of subscapular artery; amputation at upper third; hæmorrhage on sixty-seventh day; removal of humerus at joint; cured.[124b]

XII.—1868. T. S. Madden. Left traumatic aneurism due to gunshot-wound; very much swelling in the supraclavicular region, so much so that Dr. Frank Hamilton, of New York, discountenanced the operation; the artery was deeply seated and was ligated close to the outer border of the anterior scalene; it was necessary also to ligate the anterior scapular artery, as large as a crow-quill, which kept up a current after the ligature of the subclavian; cure.

The aneurism returned two years later, but we find no further record of the case.[125]

XIII.—1875. Marchesano. Traumatic aneurism of third portion of left subclavian artery. Wound produced by a blow with a sharp gouge, followed by profuse hæmorrhage, which was in part arrested by the hand of the patient; the wound was in the left lateral region of the neck, in the supraclavicular triangle, distant from four to five centimetres from the upper border of the clavicle and about two centimetres from the posterior border of the sterno-mastoid muscle; ligation of the first portion of the left subclavian. Operation performed at night by artificial light; Cooper's needle bearing the ligature was pushed as far within as possible in order to reach the other side of the wound; having ascertained that the pressure of the tightened ligature was sufficient to check the hæmorrhage, so that the direct pressure which had been applied during the operation could be dispensed with, the knot was tied; twenty days later, death from slipping of the ligature and consequent hæmorrhage.[126]

XIV.—1880. McKinnon. Left traumatic aneurism; due to pistol-ball, a little internal to the middle of left clavicle; violent hæmorrhage; on seventh day pulsating tumor extended about one and a half inches underneath clavicle; ligation of third portion exterior to the scalene; six days after operation, terrific secondary hæmorrhage; a bag of shot weighing two and a half pounds over wound; arrest of hæmorrhage; cure.[127]

XV.—1883. M. Michel. Left traumatic aneurism; from gunshot-wound; small, deep effusion of blood; no hæmorrhage from wound; on the thirtieth day after the accident violent hæmorrhage from wound under clavicle; plugging of wound in artery by thrusting the finger deeply into the wound; the artery was deeply seated; the anterior scalene had to be divided to ligate the artery; cure.[128]

XVI.—18—. O'Reilly (Dublin). Left traumatic diffused axillary aneurism; dislocation of shoulder and reduction, soon followed by aneurism; ligature of third portion; cure.[129]

XVII.—1891. Parke. Cure; left traumatic aneurism of third part; gunshot-wound; ligature of third portion; recovery, with almost total loss of motion in the thumb, index, and middle fingers. Man, aged forty years. First noticed the swelling three weeks after he was shot, and the operation was done three days later; ball extracted from the neck subsequently.[130]

SYNOPSIS OF SEVENTEEN TRAUMATIC ANEURISMS OF THE

| No. | Date. | Name of Surgeon. | Cause. | Operation. |
|---|---|---|---|---|
| I. | 1819 | Dupuytren. | Punctured wound; axillary aneurism, with much swelling in supraclavicular region. | Ligation of second portion. |
| II. | 1823 | Sawinkoff. | Carried weights with a rope over shoulder; subclavio-axillary aneurism. | Ligation of third portion, close to scalene. |
| III. | 1823 | H. L. Gibbs. | Struck with a rope; subclavio-axillary aneurism. | Ligation of third portion. |
| IV. | 1833 | Auchincloss. | Carried heavy weights on his shoulder; subclavio-axillary aneurism. | Ligation of second portion. |
| V. | 1834 | Majesté-Lallemand. | Sabre-wound in axilla; subclavio-axillary aneurism. | Ligation of second portion. |
| VI. | 1835 | J. J. Pereira. | Subclavio-axillary aneurism; cause not stated. | Ligation of third portion, close to the scalene. |
| VII. | 1835 | Earle. | Subclavio-axillary aneurism; cause not stated. | Ligation of third portion. |
| VIII. | 1844 | J. C. Warren. | Dislocation of shoulder; subclavio-axillary aneurism. | Ligation of second portion. |
| IX. | 1848 | Manec. | Shot-wound; subclavio-axillary aneurism. | Ligation of third portion. |
| X. | 1850 | V. Mott. | Fall of cask on shoulder; subclavio-axillary aneurism. | Ligation of third portion. |
| XI. | 1866 | T. G. Morton. | Bruise of supraclavicular region; high axillary or subclavio-axillary aneurism. | Ligation of second portion, and later, amputation. |
| XII. | 1868 | T. S. Madden. | Gunshot-wound, minié ball; subclavio-axillary aneurism. | Ligation of third portion, close to scalene; also of anterior scapular artery. |
| XIII. | 1875 | Marchesano. | Wounded by a sharp gouge; subclavian aneurism. | Ligation of first portion. |
| XIV. | 1880 | McKinnon. | Pistol-wound; subclavio-axillary aneurism. | Ligation of third portion, close to scalene. |
| XV. | 1883 | M. Michel. | Gunshot-wound, minié ball; subclavio-axillary aneurism. | Ligation of second portion. |
| XVI. | 18— | O'Reilly. | Dislocation of shoulder; subclavio-axillary aneurism. | Ligation of third portion. |
| XVII. | 1891 | Parke. | Gunshot wound; subclavio-axillary aneurism. | Ligation of third portion. |

### Third Portion of the Left Subclavian Artery.

| Complications. | Results. | Remarks. | References. |
|---|---|---|---|
| Abscess. | Cure. | Tumor size of a child's head. | Leçons Orales de Clinique Chirurg., 1834, Vol. IV, p. 525; Wyeth's Essays, p. 174; Norris's Contributions; Arch. klin. Chir., Bd. X. |
| . . . . . . . . . | " | . . . . . . . . . . . . . . . | Guy's Hospital Reports, Vol. XV, p. 73; Wyeth's Essays, p. 178. |
| . . . . . . . . . | " | . . . . . . . . . . . . . . . | B. C. Brodie, in Medico-Chirurg. Transactions, XII, 531; Wyeth's Essays, p. 180. |
| Cerebral symptoms; comatose. | Death. | . . . . . . . . . . . . . . . | Edinburgh Medical and Surgical Journal, Vol. XIV, p. 325, 1836; Wyeth's Essays, p. 174. |
| . . . . . . . . . | Cure. | Excessive swelling in supraclavicular region; operative wound at least three inches deep. | Recueil de Mémoires de Medécine Militaire, Paris, 1834, XXXVI, p. 176. |
| . . . . . . . . . | " | The artery was deeply seated on account of considerable swelling in supraclavicular region. | Journal de Soc. Méd. de Lisbonne, 1835, I, 149. |
| . . . . . . . . . | " | . . . . . . . . . . . . . . . | Norris's Contributions, p. 224; Arch. klin. Chir., Bd. X, p. 224; Wyeth's Essays, p. 184. |
| Abscess; hæmorrhage. | " | Great swelling in supraclavicular region; wound deep and dark. | Med. Chir. Transactions, London, 1846; American Journal Medical Sciences, Philadelphia, 1846, N. S. 539; Lancet, 1845, Vol. II, p. 620; Wyeth's Essays, p. 176. |
| Air entered external jugular. | " | . . . . . . . . . . . . . . . | Arch. klin. Chir.; Wyeth's Essays, p. 188. |
| . . . . . . . . . | " | . . . . . . . . . . . . . . . | Operator's Notes; Wyeth's Essays, p. 216. |
| Suppuration; gangrene; hæmorrhage. | " | He was a carrier of "deal planks;" had the subcutaneous thickening called a "deal runner's pad." | American Journal Medical Sciences, July, 1867, N. S. LIV, 70, and July, 1876; Wyeth's Essays, p. 176. |
| . . . . . . . . . | " | Much swelling in supraclavicular region; later on, recurrent aneurism. | Nashville Med. and Surg. Journal, Bowling, 1868, N. S. IV, p. 59. |
| Hæmorrhage. | Death. | The ligature slipped. | Observatore Medico, Palermo, Siciliano, 1875, 327. |
| Hæmorrhage. | Cure. | Bag of shot over the wound stopped the hæmorrhage. | Virginia Med. Monthly, 1880, VII, 524; also quoted by George Poinsot in Jaccoud's Dictionary, Article Artère Sous-Clavière, 1882, p. 419. |
| Hæmorrhage. | " | Artery deeply seated. | American Journal Medical Sciences, Philadelphia, 1883, N. S. LXXXVI, 439. |
| Gangrene of the fingers. | " | Diffused axillary aneurism. | Cyclopæd. Anat. and Physiology, Vol. IV, p. 616; Wyeth's Essays, p. 206. |
| . . . . . . . . . | " | . . . . . . . . . . . . . . . | Medical Record, February 15, 1890, New York, XXXVII, p. 184; also Sajous's Annual, 1891, Vol. III, p. 9. |

## Deductions.

*Left Traumatic Aneurism.*—On the left subclavian, the ligature of the second portion is as safe as that of the ligature of the third portion.[131]

The remoteness of this second portion from the heart, its situation at the far end of the arch, which arch breaks the first impulse of the heart's action, and, finally, the greater length of the first portion on the left, are as many conditions which are said to be the cause why the ligation of the second portion on the left is safer than on the right side.[132]

We must here recall that the ligation of the second portion of the right subclavian is not any safer than the ligation of the first.[133]

Out of the ten cases of traumatic aneurisms in which the second portion was ligated, there were only six on the left side (Dupuytren, Auchincloss, Majesté, Warren, Morton, Michel), and they were all cured but one (Auchincloss), there were four on the right side (Bullen, Roux, Pitha, Langenbeck No. 1), and they all died except one (Bullen).

The study of those cases of left traumatic aneurism elicit the same important and noticeable remarks which we have made in regard to the traumatic aneurisms on the right side, particularly that some cases were accompanied with little swelling and others with much swelling; these were more difficult, of course; some of them were high axillary aneurisms, but with much swelling in the supraclavicular region, making them practically aneurisms of the third portion as far as the treatment was concerned.

The most common complications are hæmorrhage, four times; sepsis, twice; both now preventable. Gangrene occurred in two cases only (Morton, O'Reilly). Cerebral symptoms in one case (Auchincloss), with death.

*Idiopathic Aneurisms of the Left Side; Treatment by Opening the Sac.*—We know of no case reported in which an aneurism of the left side had been treated by opening the sac.

*Treatment by Ligation of Arteries; Proximal Ligation of the Third Portion of Left Subclavian.*—There are fifteen cases on record of ligation of the third portion of the left subclavian as a proximal operation, by Post, Liston, Sawinkoff, Wishart, Brodie, Porter, Earle, Skey, Cooper, Warren, Mott, Demme, Ferguson, Lane, White and Huntington.

I.—1817. Post. Man, aged twenty-seven years; subclavio-axillary aneurism; hæmorrhage; sac bursts, discharging three ounces dark coagulated blood; cure.[134]

II.—1820. Robert Liston. Man, aged thirty-five years; subclavio-axillary aneurism; violent hæmorrhage from external jugular; cured.[135]

III.—1822. Sawinkoff. Man, aged thirty years; subclavio-axillary aneurism; size of an egg; under the acromial extremity of the clavicle; proximal ligature of third portion; great difficulties because of the raising of the clavicle by the tumor; cure.[136]

IV.—1823. Wishart. Man, aged forty-seven years; subclavio-axillary aneurism; abscess in axilla; cured.[137]

V.—1823. Brodie. Man, aged fifty-six years; subclavio-axillary aneurism; gangrene; exhaustion; death; thrombi on both sides of ligature.[138]

VI.—1829. Porter. Man, aged forty years; subclavio-axillary aneurism; suppuration of sac; cured.[139]

VII.—1830. Earle. Man, aged fifty-four years; subclavio-axillary aneurism, immediately below the left clavicle, just where the artery passes beneath the clavicle; size of half of a large orange; dissection to ligate the artery on the outer edge of the scalene; the finger detected a pulsating cord in the situation of the artery, under which an aneurismal needle was passed without difficulty; on examining the cord the pulsations were distinctly felt as strong as before; but on compressing it on the needle, the pulse at the wrist was not arrested and the man complained of a pain at the inner side of the elbow; it was apparent that the ulnar nerve had been surrounded and not the artery, which was immediately below it, and caused the nerve to pulsate by its close contact; before withdrawing the needle, it was armed with a silk and an assistant was requested to draw the nerve gently upward and outward; by this expedient, with a little more dissection, the naked artery was exposed fairly and readily; the same needle was passed round it, and on compressing it the pulse at the wrist was immediately arrested; then the artery was ligated; the case is considered as having recovered.[140]

VIII.—1840. F. C. Skey. Subclavio-axillary aneurism; phlebitis after operation; cured.[141]

IX.—1841. B. B. Cooper. Man, aged fifty years; subclavio-axillary aneurism; pleuritis; pneumonia; death.[142]

X.—1847. Warren. Remarkable deviation of the vessel due to a double curvature of the spine.

A lady, thirty years of age, had a congenital club-foot of the worst kind, and a double curvature of the spine. She consulted me in the early part of December, 1847, for an aneurismal tumor, situated just above the scapula end of the clavicle, about the size of a pigeon's egg. It showed itself after drawing a cork. I endeavored to discover the subclavian artery in its normal situation beneath the clavicle at the point where it passes over the first rib. No large vessel, or any osseous protuberance answering to the tubercle of the first rib, usually taken as the guide to the artery in this position, could be found. Different parts of the neck were then explored, which led to the discovery of a large artery passing obliquely upward, parallel to, and about an inch removed from, the external border of the trapezius muscle. Compression being made at this point, the pulsations of the tumor ceased, as well as the pulse at the wrist. There was no question, therefore, in my mind, that this was the subclavian artery: but it was more difficult to determine the cause of this remarkable anomaly. I now sought for the first rib, and discovered both the first and a part of the second rib passing obliquely across the neck above the clavicle. The whole osseous system of the chest, in this case, had undergone a partial displacement. The spine and ribs attached had been, as it were, moved upward; while the sternum was carried in an opposite direction.

As the tumor was rapidly increasing it was evident that, considering its situation and the great danger of delay, no time was to be lost, if any surgical operation was to be resorted to. The operation was performed on December 24, 1847, the pulsations of the vessel being the principal guide, as the other anatomical marks were wanting; a cut opened one of the branches of an artery given off from the thyroid axis, which was tied. Directly over the artery a large vein, apparently the external jugular, was encountered. The aneurismal needle unarmed was passed from below upward, on account of the difficulty of introducing it in the opposite direction, from the interference of the scalenus anticus, which had its insertion just below. The instrument was now threaded with the ligature and withdrawn. The pulsations in the aneurismal sac, as well as those of the radial artery at the wrist, at once ceased, and all appearance of tumor vanished. A number of large vessels, taking their origin from the subclavian, exist in different parts of the neck. One of these, apparently the suprascapular, passes directly over the sac and pulsates so strongly as to convey the impression of a return of pulsation in the aneurismal tumor. The ligature separated ninety-six days after the operation.

I saw this patient on September 14, 1848, for the last time. At that period she was quite well. The aneurismal tumor had in a great measure disappeared; but it still conveyed the impression of containing a fluid. Directly on its surface and incorporated with it was a very large arterial trunk supposed, as above stated, to be the suprascapular. This vessel pulsated powerfully and at first gave an appearance of pulsation to the tumor, but, by careful manipulation, could be separated from it, the pulse at the wrist still remained a little less strong than in the corresponding artery of the other side.[143]

XI.—1850. V. Mott. Man, aged thirty-five years. Subclavian aneurism; another vessel was seen to pulsate along-side of the subclavian; it was tied also, and then all pulsations ceased and did not return; cured.[144]

XII.—1858. Demme, Sr. Man, aged (?) years. Subclavio-axillary aneurism; cured.[145]

XIII.—1872. Sir Wm. Ferguson. Man, aged forty years. Subclavian aneurism; thoracic duct supposed to have been wounded; death.[146]

XIV.—18—. L. C. Lane. It is a remarkable case of secondary recurrent hæmorrhage and secondary ligatures.

A miner from Alaska. Left subclavio-axillary aneurism, size of a large orange; ligature of the subclavian close to the scalenes; in one week primary union of the wound; near the end of the second week the man rises from his bed to use the closet stool; slight bleeding through the reopened wound; later, another violent bleeding occurred; on the fourteenth day the wound was opened, and while the blood that gushed from the distal end was controlled by sponge used as a tampon, the artery was exposed by severing the sternal leg of the sterno-cleido-mastoid muscle, and a thread thrown around the subclavian *just as it emerges from the thorax,—i.e., on the first portion;* this so controlled the bleeding that a ligature was passed also around the vessel close to the aneurism on the proximal side; no more hæmorrhage; the vitality of the limb was well maintained; on the nineteenth day after the first ligature death by exhaustion.[147]

XV.—1885. White and Huntington. Aneurism of left subclavian; outer third; ligation of the subclavian artery at the middle third; recovery; death later from rupture of an aneurism of the abdominal aorta; autopsy; left subclavian and axillary arteries occluded between the origins of the superior intercostals and acromio-thoracic.[148]

*Proximal Ligation of the Second Portion of Left Subclavian.*—The following case is the only one recorded where the second portion of the left subclavian was tied for spontaneous aneurism.

1883. Case of Auchincloss. Man, aged sixty-five years. Subclavio-axillary aneurism; cerebral symptoms; death; purulent infiltration in region of the wound.[149]

*Ligation of the First Portion Alone of the Left Subclavian.*—Wyeth considers the operation of the ligation of the first portion of the left subclavian as the most formidable in the domain of operative surgery.[150]

It has been undertaken regularly only once, by J. Kearney Rodgers, of New York, and the case terminated fatally.[151]

Parker's case of ligature of the subclavian, carotid, and vertebral is on the left side, says Gross.[152]

Wyeth says on the right side.[153]

However, Dr. Halsted, before removing the sac of the aneurism in his remarkable case, ligated the left subclavian as it emerges from the chest.

Dr. Lane also asserts positively, in a personal communication to the writer, that, when he said he ligated the artery just as it emerges from the thorax, he meant that he ligated the first portion.

The operation for ligation of the first portion of the left subclavian is more difficult and dangerous, since the vessel is more deeply situated and has the thoracic duct in close proximity.[154]

On account of the intimate relations of the thoracic duct to the left subclavian artery, as the vessel goes behind the scalenes, the ligation should not be attempted close to this muscle, nor should the dissection be carried fully to the scalenes.[155]

It should be tied as low down as possible, the duct being less likely to be injured here, since in passing behind the aorta it is deeper than the artery.

However, since the thoracic duct has two or three terminal branches (W. W. Keen), the risk is not as great.[156]

On the left side the ligature of the thyroid axis and internal mammary artery near their points of origin is not justifiable, on account of the proximity to the thoracic duct.[157]

The memorable pioneer case is that of Dr. J. Kearney Rodgers.

It was universally regarded as impracticable to ligate the left subclavian in its first portion on account of its numerous important and dangerous relations.

No one had yet been found ingenious enough to devise and bold enough to execute such an enterprise.[158]

The patient was a man, aged forty-two years. In lifting a heavy weight he was suddenly seized with an aneurism of the third portion; admitted into the New York Hospital; tumor the size of a hen's egg; operation on October 14, 1845. Great difficulty in reaching the artery safely; wound as deep as the finger's length, and still greater difficulty in passing a ligature, although using a needle with a movable point; hæmorrhage on October 26; death fifteen days later; proximal end of subclavian plugged; distal end plugged with soft, imperfect clot; the vertebral was given off at the site of the ligature, was almost patulous, and evidently had been the seat of the hæmorrhage which caused the patient's death.

Dr. Rodgers regretted he had not secured the vertebral artery and also the thyroid axis, believing that this would have effectually prevented the fatal hæmorrhage.

It was acting upon this suggestion that Professor Willard Parker, in September, 1863, tied the right subclavian artery on the inside of the scalene, the carotid, and the vertebral, but also with a fatal result.[159]

*Distal Ligation of the Third Portion of the Left Subclavian.*—We found mention of only one case in which the third portion of the left subclavian had been ligated as a distal operation for an aneurism of that same portion of the artery.

It is the case of Professor Toland, of San Francisco. Spontaneous aneurism; left subclavian artery; third portion; distal ligation; recovered from operation; cured.[160]

*Distal Ligation of Axillary Artery on Left Side for Left Subclavian Aneurism of Third Portion.*—There is only one case of ligation of the left axillary artery as a distal operation.

It is the following:

1874. R. A. McLean. Aneurism of third portion of the left subclavian,—large pulsating tumor in left supraclavicular region; distal ligation of the third portion of the axillary artery; the pulsation in the tumor was perceptibly lessened immediately after the ligation and gradually decreased up to the sixth week after the operation, after which no pulsation or bruit could be discovered. Ligature came away on the twentieth day and wound healed a few days afterwards. The tumor is at least one-third smaller than when the operation was performed; it is hard to the touch and is evidently being rapidly absorbed.[161a] Tumor grew anew; hæmorrhages from tumor; death eight months after operation.[161b]

*Treatment by Extirpation of the Sac on the Left Side.*—It was on the left side that Dr. Halsted successfully removed, for the first and only time, a *pulsating* aneurism of the third portion of the subclavian.

Four incisions and three flaps; excision of the inner third of the clavicle; ligation of the first portion of the subclavian artery as it emerges from the chest; ligation of the second portion of the axillary artery; double ligature above and below the sac of the subclavio-axillary vein, which was adherent to the sac; dissection and removal of the sac, together with the excised clavicle and the ligated vein, all in one piece; operation lasted three hours and a half; cure.

A favorable circumstance was that the aneurism was partly filled with hard clots, but it still pulsated, though feebly.[162] In Dr. Schopf's case there were no pulsations at all.

It is Dr. Halsted, also, who truly has then, for the first and only time, *successfully* ligated the first portion of the left subclavian.

A recent letter from Dr. Halsted states that the man has continued well and has a very fair use of his limb.

*Treatment by Amputation at the Shoulder-Joint on the Left Side.*—Heath reports a case of amputation at the shoulder-joint for an aneurism of the third portion of the left subclavian with no apparent benefit to the aneurism.[163]

In the discussions that followed this report in the Medico-Chirurgical Society,[164] it was stated that amputation at the shoulder had been done *four times* (without saying on which side) with apparent benefit in only one case, that of Mr. Spence, of Edinburgh.[165]

The patient seems never to have quite lost pulsation in the aneurism, though he survived four years.[166]

The following is *another case* (Charles A. Morton):

Left subclavian aneurism, third portion, size of half of a large orange; Macewen's treatment; finally, amputation at shoulder-joint; aneurism continued to increase; hæmorrhage; death.[167a]

We will recall here the case of left traumatic aneurism of T. G. Morton, related above. It was a high axillary aneurism presenting sloughing and hæmorrhage, which compelled amputation at the shoulder-joint; the patient recovered.[167b]

However, if such procedure is justifiable, it is surely on that side in view of the difficulties and dangers of the ligation of the first portion, if the second portion cannot be safely ligated.

Synopsis of Twenty-four Idiopathic Aneurisms of the

| | Operations. | Operators. | Complications. |
|---|---|---|---|
| I. | Needling. | (?) | (?) |
| II. | Opening of the sac. | No cases. | . . . . . . . . . . . . . . . . . |
| III. | Proximal ligatures. | . . . . . . . . . . . | . . . . . . . . . . . . . . . . . . |
| | A. Proximal ligature of the third portion of the left subclavian. | . . . . . . . . . . . | . . . . . . . . . . . . . . . . . . |
| | I. | 1819. Post. | Hæmorrhage. |
| | II. | 1820. Liston. | Hæmorrhage from external jugular. |
| | III. | 1822. Sawinkoff. | . . . . . . . . . . . . . . . . . |
| | IV. | 1823. Wishart. | Abscess in axilla. |
| | V. | 1833. Brodie. | Gangrene. |
| | VI. | 1829. Porter. | Suppuration of sac. |
| | VII. | 1830. Earle. | . . . . . . . . . . . . . . . . . . |
| | VIII. | 1840. F. C. Skey. | Phlebitis after operation. |
| | IX. | 1841. B. B. Cooper. | Pleuritis; pneumonia. |
| | X. | 1847. J. M. Warren. | Deviation of the artery. |
| | XI. | 1850. V. Mott. | . . . . . . . . . . . . . . . . . |
| | XII. | 1858. Demme, Sr. | . . . . . . . . . . . . . . . . . . |
| | XIII. | 1872. Wm. Ferguson, Sr. | Thoracic duct supposed to have been wounded. |
| | XIV. | 18—. Lane. | Secondary recurrent hemorrhage and secondary ligatures of first portion. |
| | XV. | 1885. White and Huntington. | . . . . . . . . . . . . . . . . . . |
| | B. Proximal ligature of second portion of left subclavian. | 1833. Auchincloss. | Suppuration; cerebral symptom. |
| | C. Ligature of the first portion. | 1845. K. Rodgers. | Hæmorrhage from vertebral. |
| IV. | Distal ligature of the third portion. | 1864. Toland. | . . . . . . . . . . . . . . . . |
| V. | Distal ligature of axillary. | 1874. R. A. McClean. | None. |
| VI. | Extirpation of the sac. | 1892. Halsted. | . . . . . . . . . . . . . . . . . |
| VII. | Amputation at the shoulder-joint. | Charles Morton. | Hæmorrhage. |
| | | Charles Heath. | . . . . . . . . . . . . . . |
| | | Spence, of Edinburgh. | . . . . . . . . . . . . . . . . . . |
| | | T. G. Morton. | Sloughing and hæmorrhage. |

THIRD PORTION OF THE LEFT SUBCLAVIAN ARTERY.

| Results. | Remarks. | References. |
|---|---|---|
| (?) | (?) | (?) |
| . . . . . . | . . . . . . . . . . . . | . . . . . . . . . . . . . . . . . . . . . . . . . . |
| . . . . . . | . . . . . . . . . . . . . | . . . . . . . . . . . . . . . . . . . . . . . |
| . . . . . . | . . . . . . . . . . . . . | . . . . . . . . . . . . . . . . . . . . . . . . . . . |
| Cure. | Subclavio-axillary aneurism. | Cooper in Med. Chir. Trans , 1818, p. 186; Wyeth's Essays, p. 177. |
| " | Subclavio-axillary aneurism. | Norris's Contributions of Practical Surgery, p. 222; Edinb. Med. and Surg. Journ., Vol. XVI; Wyeth's Essays, p. 180. |
| Cure. | Subclavio-axillary aneurism. | Journ. Chirurgie; Augenheilkunde, VI, 662; Guy's Hospital Reports, Vol. XV, p. 69; Wyeth's Essays, p. 178. |
| " | Subclavio-axillary aneurism. | Guy's Hospital Reports, Vol. XV, p. 73; Wyeth's Essays, p. 178. |
| Death. | Subclavian aneurism; thrombi on both sides. | Arch. klin. Chir., Bd., p. 222; Wyeth's Essays, p. 182. |
| Cure. | Subclavio-axillary aneurism. | Dublin Hospital Reports, Vol. XV, p. 198; Guy's Hospital Reports, Vol. XV, p. 73; Wyeth's Essays, p. 182. |
| " | Subclavio-axillary aneurism. At first the nerve was tied by mistake. | Med. Gazette, London, 1830, Vol. VI, p. 241; Norris's Contrib., p. 224; Arch. klin. Chir., Bd. X, p. 224; Wyeth's Essays, p. 184. |
| " | Subclavio-axillary aneurism. | Lancet, 1840, p. 376; Wyeth's Essays, p. 178. |
| Death. | Subclavio-axillary aneurism. | Guy's Hospital Reports, Vol. XV, p. 70; Wyeth's Essays, p. 188. |
| Cure. | Subclavian aneurism. | Surgical Observations, 1867, p. 429; Wyeth's Essays, p. 178. |
| " | Subclavian aneurism. | Operators' Notes, A. B. Mott to Wyeth's Essays, p. 216. |
| " | Subclavio-axillary aneurism. | Arch. klin. Chir., Bd. X, p. 236; Wyeth's Essays, p. 206. |
| Death. | Subclavian aneurism. | Lancet, 1872; Wyeth's Essays, p. 212. |
| " | Subclavio-axillary aneurism. | Pamphlet printed by Stanley & Davis, 543 Clay St , San Francisco, Cal. |
| Cure. | Subclavian aneurism. | Report of Surgeon-General, United States Army, Washington, D. C., 1885, p. 104. |
| Death. | Subclavio-axillary aneurism. | Edinburgh Medical and Surgical Journal, 1836, Vol. XIV, p. 325; Wyeth's Essays, 574. |
| " | Proximal and subclavian plugged; distal end also closed by soft plug; vertebral patulous. | Gross's System of Surgery, 1882, Vol. I, p. 756; N. Y. Med. Journ., March, 1846; Guy's Hospital Reports; Wyeth's Essays, p. 170. |
| ?) | Subclavian aneurism; recovered from operation. | Western Lancet, San Francisco, 1872, Vol. II, p. 352; Am. Journ. of Med. Sci., 1864, p. 562; Wyeth's Essays, p. 218. |
| Death eight months after operation. | Tumor grew again; hæmorrhage from tumor. | Western Lancet, San Francisco, 1874, Vol. II, p. 352; Personal letter to writer. |
| Cure. | Subclavio-axillary aneurism. | Johns Hopkins Hospital Bulletins, July–August, 1892, p. 93. |
| Death. | Aneurism continued to grow after operation. | British Medical Journal, London, 1894, I, p. 1070. |
| Nul. | . . . . . . . . . . . . | London Lancet, 1880, Vol. I, p. 168. |
| Cure. | Same pulsations persisted. | Med Chir. Trans., Vol. II, p. 206; British Medical Journal, June, 1380, Vol. I, p. 924. |
| " | High axillary aneurism; was of traumatic origin. | Holmes's System of Surgery, Packard, 1881, Vol. II, p. 414; International Encyclopædia of Surgery, Ashhurst, 1883, Vol. VIII, p. 511; American Journal of the Medical Sciences, July, 1867, p. 70; Wyeth's Essays, p. 176. |

### DEDUCTIONS.

*Left Idiopathic Aneurisms.*—The perusal of the preceding tables of 24 idiopathic aneurisms of the left side shows that out of 25 operations of all kinds, 12 recovered.

Out of 18 ligations of all kinds, 11 recovered.

Out of 17 proximal ligations, 11 recovered.

Out of 15 proximal ligations of third portion, 11 recovered.

The single case of ligation of the second portion died; also the only case of ligation of the first portion died.

Hæmorrhage occurred 5 times out of the 24 operations; sepsis, inflammation, etc., 6 times.

Ten of the 24 cases were subclavian aneurisms; the balance were subclavio-axillary aneurisms.

*Recapitulatory Tables of the Final Results of the Operative Treatment of Aneurisms of the Third Portion.*—(1) *General Table*, including all kinds of aneurisms and all kinds of operations.

There are 115 operated cases: 31 traumatic, 81 idiopathic, and 3 recurrent.

Of these 115 cases 40 recovered, or about 35 per cent.

Sixteen different kinds of operations were performed; 13 different kinds of ligations.

(2) *Table of Final Results of Traumatic Aneurisms.*—Out of 31 traumatic aneurisms, 19 recovered, about 66 per cent.

Four on right side: 2 out of 3 by incision of sac and ligature of both ends (Langenbeck, No. 2, Miles); 1 out of 3 by ligature of second portion (Bullen); 1 out of 1 by ligature of innominate and carotid (Lewtas).

Fifteen on left side: 10 out of 10 by ligature of third portion (Sawinkoff, Gibbs, Pereira, Earle, Manec, Mott, Madden, McKinnon, O'Reilly, Parke); and 5 out of 6 by ligature of second portion (Dupuytren, Majesté-Lallemand, Warren, Morton, Michel).

(3) *Table of Final Results of Idiopathic Aneurisms.*—Out of 81 cases, 21 recovered, about 25 per cent.

Eight on right side: 1 out of 1 by incision of the sac and ligature of both ends (Syme); 1 out of 11 by proximal ligature of third portion (Green); 1 out of 2 by ligature of innominate and carotid (Coppinger); 1 out of 2 by ligature of innominate, carotid, and, later, vertebral (Smyth); 1 out of 1 by distal ligation of third portion and carotid (Monod); 1 out of 1 by extirpation of the sac (Schopf); 2 out of 5 by amputation at the shoulder.

Thirteen on left side: 10 out of 10 by proximal ligation of the third portion (Sawinkoff, Gibbs, Pereira, Earle, Manec, Mott, Madden, McKinnon, O'Reilly, Parke); 1 by extirpation of the sac (Halsted); 2 by amputation at the shoulder (Heath, Spence).

*Recapitulatory Table of the Complications.*—Of 115 aneurisms of all sorts, 79 presented complications (about 60 per cent.), of which 17 recovered (about 19 per cent.).

(1) Hæmorrhage occurred in 48, of which 10 recovered (about 20 per cent.).

(2) Inflammation, suppuration, sepsis occurred in 15, of which 5 recovered (33 per cent.).

(3) Pleuritis, pneumonia, pericarditis, bronchitis occurred 7 times, and they all died.

(4) Phlebitis occurred in 2 cases, of which 1 recovered.

(5) Cerebral symptoms in 5 cases, and they all died.

(6) Gangrene occurred in 4 cases, of which 3 recovered (75 per cent.).

(7) Penetration of air in veins occurred in one case in external jugular vein; it recovered.

(8) Wound of thoracic duct occurred in 1 case; it recovered.

(9) Wound of pleura occurred in 1 case; it recovered.

(10) Shock in 1; it died.

(N. B.—For the relative frequency and gravity of each complication, see special tables of each kind of aneurism and each kind of operation performed.)

The two greatest factors in fatalities are, therefore, hæmorrhage and sepsis. They must and they shall henceforth disappear from the field with the thorough aseptic and antiseptic precautions. Mortalities will then decrease in a wonderful proportion.

However, the teachings derived from all the other factors connected with the thrilling history of aneurisms of the third portion will remain, and must constantly be borne in mind to be conquered in their turn.

*Recurrent Aneurisms of the Left Side.*—There is but one case of recurrent aneurism on the left side; it is that of T. S. Madden, related above.[167c]

It was of traumatic origin. The proximal end of the wounded artery had been ligated, but not the distal end.

No operation had been performed as far as the records show, and the patient did not seem to be much troubled with his disease.

Injudicious and undue use of the limb on the affected side seemed to be the cause of the aneurism.

## Arterio-Venous Aneurisms of the Third Portion of the Subclavian.

Arterio-venous aneurisms of the large arteries and veins of the neck are less frequent and less dangerous than the arterial aneurisms of the same arteries.

It is thought by some that the injury of the vein is what saves the patient, because, if either vessel was injured alone, it would be more serious.

Still, simultaneous wounds of artery and vein are sometimes followed by death, as shown by the following case:

I.—Will Ogilvie. Narrow wound on the outer side of the left subclavian artery near its origin; at the same time the vein had also been wounded in a similar place; repeated hæmorrhages; death on the nineteenth day; in the last days of his life he presented a tumor of four by five inches, extending above and below the clavicle; it was pulsatile; hæmorrhages were taking place by the very apex of the tumor.[168]

The following are the only other cases the writer could find recorded:

II.—Patient in Charity Hospital, New Orleans, La. Gunshot-wound of the neck; slight transient hæmorrhage; persistence of a small pulsating and thrilling tumor; patient died seven years later;

autopsy showed an aneurism, arterio-venous, between the subclavian artery, internal jugular vein, and subclavian vein.[169]

III.—Robert. Gunshot-wound above left clavicle; recovery; good health, but for uneasiness caused by a continuous thrill or murmur about the clavicle, neck, and axilla; it was audible at a distance; the hand perceived strong vibrations.[170]

IV.—Larrey. Punctured wound in supraclavicular region; development of a considerable tumor with pulsation and a thrill; jugular and cephalic veins much dilated and pulsating.[171]

V.—Letenneur, of Nantes. 1865. Gunshot-wound; diffuse tumor; thrill extending under sterno-mastoid, upper half of sternum, and under clavicle.[172]

VI.—Sanson reports a case due to gunshot-wound; it presented no serious symptoms.[173]

VII.—Larrey reports another case due this one to a gunshot-wound, followed by no serious disturbance.[174]

VIII.—Gross says he has had a case under his own observation during six years, and the only annoyance experienced was from the noise of the tumor.[175]

As regards the treatment, all surgeons agree to let such aneurisms alone.

However, in some cases the tumor may grow, may cause pain, and may interfere with the usefulness of the arm; in some cases the noise is intolerable to patients, often preventing sleep. What is to be done, then? Should we operate or not, and what operation should be performed?

We must bear in mind that the vessels here are large and that the ligation of either is apt to be followed by gangrene.

The ligation of the artery, however, when followed by gangrene is without remedy, save amputation.

The ligation of the vein is not without remedy, *when* the symptoms following the ligature of the vein become threatening, since they can be often stopped by ligating the main artery of the limb *below* the largest collateral,—that is below the scapular or below the deep brachial, as demonstrated by the admirable and imperishable labors of Braune, of Leipsic; of H. Braune, of Heidelberg; of Henicken, of Langenbeck; of our own home prides, John A. Liddell, of New York; Samuel W. Gross, of Philadelphia; Lewis S. Pilcher, of Brooklyn.[176]

## APPENDIX.

It was not without peculiar and somewhat thrilling incidents that the unique, splendid, and invaluable specimen of Dr. Smyth's case, finally landed in our grand National Museum, where the skilful pathologist will surely make it live as long as perishable matter can be made to last.

A few hours after the poor celebrated patient had died, the body was carefully embalmed, and with the greatest solicitude injected with cocoa-butter and carmine, which gave a most penetrating injection.

As soon as ready, I started dissecting it with the most intense and anxious interest, and with as much celerity as possible, because the friends of the dead man were chafing to have the remains to bury them in a style befitting such an illustrious personage. He had no family, but he belonged to a colored association whose members were very proud of the great celebrity the man had acquired, as they judged from the attention and curiosity which followed him and all his movements.

They were very pressing and impatient in their demands for the body, and we were giving them all sorts of excuses, hoping to wear out their patience. I, for one, was doggedly determined that they should not have him without dividing with me, and I wanted the lion's share.

One morning, as I was getting through with the dissection, I heard a great row in the waiting-room of the dead-house. This was situated in the rear of the hospital block, on Gravier Street, whereas the entrance was in front, of course, on Common Street, a distance of about 300 feet.

I recognized the voice of Dr. Smyth, clamoring over the others, trying to pacify them again. He had a great deal of influence over them, being himself a Republican, but this time, I thought, his prestige was ebbing fast, and I decided upon a bold *coup d'état* to preserve the to-be world-renowned specimen.

So I quickly separated the interesting parts from the balance of the corpse, wrapped them up in an old sac-cloth that happened to be laying there, and passed the package out through a window to an assistant keeper of the dead-house, telling him to carry it to my coupé, which was standing in front of the hospital. I then leaped through the same window and took the garden walk opposite to the carrier, that he might not be suspected.

I reached the front door and my carriage before him. Taking the much coveted specimen from the carrier and placing it tenderly on the seat next to me I drove off at once to the college, hugging closely my precious and ghastly companion.

After resisting the dead man's friends as long as he possibly could, Dr. Smyth had to yield to them. But judge of their shock and horror when they saw all that was left of their saint; two legs, with the viscera, and a left arm, without being able to find out where the balance had gone and by what way.

I do not think they know it to this day. They had to be contented with what they could get, and they made as much of it as if it had been the whole of their friend.

Dr. Smyth himself was as much surprised and at a loss as they, but more happily so. He was very glad when he knew where the specimen had gone. It was some satisfaction, he said, to be able to prove to all that the arteries he said he had ligated had really been tied.

From the college I removed the specimen to an adjoining building for fear that the enraged friends might institute a search for him. There he remained quietly, unknown to all but myself, in an old whiskey-barrel filled with water and alcohol. I could ill afford then the necessary expense of keeping him in a finer style, however deserving of it he was. Besides, I did not care to exhibit him much, any way.

A year or so later Professor Richardson asked me where the famous dissection was. Having told him, and also what a drain he was on my then shallow treasury, he asked me if I would not consent to have it sent to the Army Medical Museum, to which I gladly consented at once.

There, I felt sure, he would be treated in a manner becoming such a unique relic.

So Dr. Richardson and Dr. Groenvelt arranged to have it sent to Washington, where it now rests in peace, in all its glory, in a beautiful all-glass box with a fine crystal lid, bathed over head in pure alcohol, the admiration of all who love subclavian aneurisms of the third portion.

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# LARGE CYST OF THE PANCREAS TREATED BY LATERAL INCISION AND DRAINAGE; RECOVERY.

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OF BALTIMORE.

THE following case, in the practice of Dr. H. A. Kelly, is of interest, both on account of the rarity of the disease, the difficulties of diagnosis, and the position in which the incision was made.

As a rule, a positive diagnosis of cyst of the pancreas is extremely difficult, and, in fact, many of the published cases have been operated on with an expectation of finding an ovarian cyst, echinococcus cyst of the liver, abscess of the anterior abdominal wall, effusions into the lesser peritoneal cavity, etc., and not until the incision was made and the relations of the cyst carefully investigated was the condition recognized.

In the following case the diagnosis was based on the position of the tumor, its well-marked ovoid outline and tense fluctuant feel, together with the slow, steady increase in size, the gradual emaciation, and the previous history of the size and relations of the tumor.

The treatment was by incision, closing off of the general peritoneal cavity by suturing the cyst wall to the wall of the abdomen, and drainage; the point of chief interest being the site of the incision, in the left flank just below the margin of the ribs, instead of in front or behind.

The reason for making the incision in this position was that here there would be the least interference with other abdominal organs, and that the cyst presented most prominently on the left flank.

The patient, a single woman, aged thirty-eight years, was first seen in consultation with Dr. Thodixas Shearer several weeks before the operation. The family history was without special interest, and she always considered herself a healthy woman ; there was no history of injury before the onset of the present illness, which began about six months before. It began with a great deal of pain in the umbilical and epigastric regions, accompanied by much nausea and vomiting ; she thought at the time it was simply an acute gastritis, of which she had already suffered several attacks. The pain, however, did not disappear in a few days, as was usual, but changed its position, being felt now more under the edge of the ribs, most marked on the left side. About two months later, the patient first noticed a tumor, which was then small and somewhat elongate in shape, occupying the position of the pancreas.

Since then tumor has steadily increased in size, pushing more and more towards the left hypogastric region, and slowly changing in shape from an elongate to a more nearly spherical mass. The patient has gradually lost weight and strength, her appetite has been poor, her food digested badly, and lately has had much nausea with vomiting at times.

At the present time she appears much emaciated, the skin is of a peculiar yellowish white color, and the tongue is coated with a dirty whitish fur.

She complains chiefly of a drawing sensation and of pain on the left side under the costal margin, but there is no tenderness on pressure in this region.

The respirations are slightly increased in rapidity, but pulmonary resonance is of good quality, and the respiratory murmur clear. The heart-sounds are clear, the apex being pushed upward, out of position, by the tumor ; the pulse is small and wiry.

On inspection of the abdomen a tumor is seen, ovoid in shape, located chiefly in its upper portion and on the left side. The left side of the thorax is markedly pushed out, and the left side of the abdomen is much more prominent than the right, the tumor reaching on the right only to the semilunar line ; the skin over it is tensely drawn and has a shiny appearance.

The tumor is smooth, except at one place on the anterior surface where there is a superficial boss about eight centimetres in diameter ; its oblique diameter from right to left is twenty-four centimetres (nine and a half inches) ; its vertical diameter is twenty centimetres (eight inches).

On palpation the borders are rounded, it is very tense and resilient, and there is a marked fluctuation wave.

Percussion gives a dull tympanitic note over the anterior portion of the tumor, the flattest note being elicited at a point in the left flank just below the eleventh rib.

The urine is of a low specific gravity and shows a faint trace of albumen. No sugar present. On microscopical examination a few hyaline casts are found.

After an operation had been decided on, the question came up as to whether it would be possible to extirpate the tumor as has been done by several surgeons, or whether it should be incised and drained, as advised by most writers on the subject, and if drained, where should the incision be made.

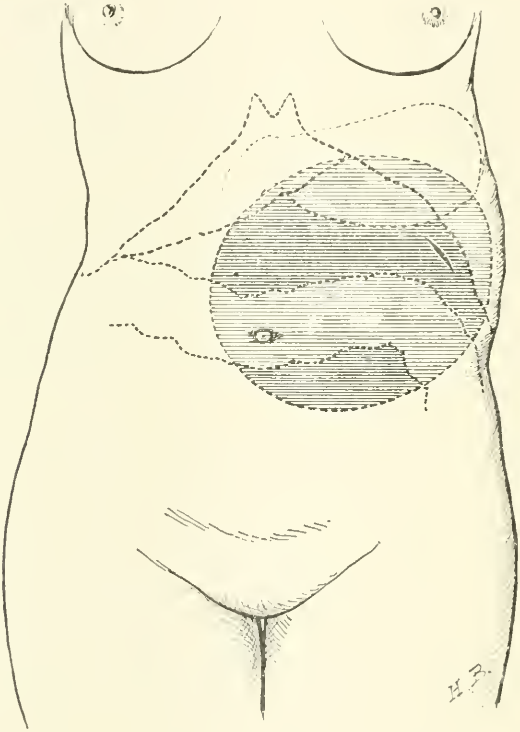
The question of extirpation was only thought of to be laid aside, because, unless the cyst was pediculated, the extirpation would be almost impossible, and even if pediculated and non-adherent, the relations of the pancreas to the surrounding organs, especially to the important blood-vessels, are so close and intimate that the operation is a most difficult and dangerous one; the percentage of mortality is, at least, 50 per cent.

Drainage of such cysts has been done successfully a number of times, by various surgeons, and gives a good prognosis as to life and cure. The incision is generally made on the anterior abdominal wall either on the median line or a little to the right or left. A French surgeon also has advised making the incision through the posterior abdominal wall; by both of these methods, however, the other abdomina viscera are likely to be in the way and complicate the operation. Having these facts in mind, it was determined to make the incision in the left flank, especially as it was determined by percussion that the colon was pressed entirely out of the way, and that in this position the tumor presented most prominently.

Operation performed March 20, 1895. The patient, having been anæsthetized, was placed on the table, lying on the right side. The skin on the left side of the anterior abdominal wall and on the left flank was shaved, washed thoroughly with green soap, alcohol, and ether, and finally sponged over with permanganate of potash, and decolorized with oxalic acid, which was removed by the liberal use of sterilized water.

The incision was made transversely through the area of greatest dulness in the left flank, just below the free border of the ribs. The skin and muscle were incised until the peritoneum was reached, which was then raised. nicked, and divided on the finger.

The cyst presented in the opening, covered by several layers of peritoneum, with a large blood-vessel coursing through it; this it was necessary to displace somewhat before a free space could be found through which the cyst could be reached.



Kelly's case of pancreatic cyst. The left side bulged out by the tumor, the dark shaded mass. The stomach is pushed up and the colon crosses the growth. The cut where the tumor was drained is seen under the left ribs

The wall of the cyst was smooth, of a reddish brown color, and apparently non-adherent. It was caught with artery forceps to prevent it from slipping, and a trocar and canula of about two millimetres in diameter were introduced. The withdrawal of the trocar was followed by a spurt of a dark, muddy, sherry-colored fluid. Three litres of this fluid were removed before the cyst was thoroughly collapsed. The canula was then withdrawn, and an incision five centimetres in length was made through the cyst wall, corresponding in direction with the abdominal wound; two silkworm-gut sutures were passed, one at either end of the wound, entering the skin, passing through all the layers of the abdominal wall, catching up the wall of the cyst, and being brought out near the point of entrance, so as to hold the wound in the cyst in the proper relation to the abdominal wound. A continuous silk suture was then passed, first through the subcutaneous tissues of the abdominal wall, then through the cyst wall, beginning at the anterior end of the wound and continued to the posterior; a similar suture was introduced in the other side of the wound, and carried backward in the same way, when the posterior ends and then the anterior ends of the two sutures were tied together, and a continuous suture surrounding the whole wound was obtained with perfect apposition of the cyst wall to the abdominal wall. About a metre of plain sterilized gauze, made in a strip eight centimetres in width, was used to pack loosely the interior of the cyst. and the usual dressings of sterilized gauze and cotton applied, held in place by a modified Scultetus bandage.

The patient passed a very comfortable night, the pulse changing in character entirely, being full and soft instead of fine and wiry; she had no nausea and was able to take a small amount of liquid nourishment by mouth.

On the second day she was very comfortable, and the dressings soaked with the discharge were removed, when the skin for some distance around the wound was found much reddened and macerated. This condition of the skin around the wound has been noted by several observers, and has been thought due to the digesting properties of the pancreatic juice.

The whole convalescence has been entirely satisfactory; the gauze drain was slowly removed, a small piece being taken off daily; after it had all been removed, narrower strips were at first used, then rubber drainage-tubes, and now the patient wears a small silver tube which Dr. Kelly has had made especially for her. She has never been troubled with nausea or vomiting since her operation; the appetite and digestion have been good and she has steadily gained in flesh. Her bowels have moved regularly, the stools normal in color and consistency. The urine is passed freely; no albumen present; sugar has never been found.

She is able to take up her daily life comfortably, the only drawback being the presence of the fistula. It has now been seven months since the operation and the discharge is still free. The question now is whether finally, as in the great majority of cases, the discharge will cease and the fistula close, or whether it will be necessary to keep it open always.

. It seems most probably from the amount of secretion at the present time, and from the size of the cyst and the pressure under which the contained fluid was, that there must still be a great deal of gland substance involved and functionally active; if this is the case, the prognosis for speedy closure is not very good.

The cyst contained three litres of dark sherry-colored fluid, looking a good deal like water in which leaves had lain for a long time. The consistency was thin and slightly sticky; it was faintly alkaline on reaction, the specific gravity 1010.

On boiling, there was a thick deposit, found to contain both serum-albumen and serum-globulin; emulcified fat slightly; no mucin or pseudo-mucin present. Under the microscope the fluid showed numerous large granular cells, free yellowish granules, a few large vacuolated cells with nuclei, and many red blood-corpuscles.

The walls of the cyst were uniformly about two millimetres in thickness, dark in color, consisting of two layers, an outer, thin, vascular layer, connected by some loose connective tissue with the firm brown cyst wall, and an inner surface, dark-brown in color, roughened, and thrown into numerous folds by the collapse after removing the fluid contents.

# CASE OF INTRA-UTERINE FRACTURE OF THE TIBIA RESULTING IN CONGENITAL ANKLE DEFORMITY.

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I WISH to report the case of Willie S., aged seven months, the child of Irish-American parents. His family history, in view of his own deformity, is exceedingly interesting. His grandfather, as well as his father, lacked the middle finger of each hand. His sister is without middle finger and corresponding metacarpal of the right hand. I have elsewhere[1] reported her case with photograph. There is no history of congenital deformity in the family of the mother.

With exception of the deformity I shall describe Willie S. was an exceedingly well-developed, healthy-looking child. Excepting his right leg his bones were perfectly normal and no signs of rachitis were discoverable, here or elsewhere. The deformity was noticed at the birth of the child, and, according to the mother's statement, had changed but little since that time, having possibly grown slightly worse in degree. The mother has repeatedly assured me that during all the period of her gravidity she suffered no accident whatever; she received no blow of any kind against the abdomen nor was her pregnancy in any other way whatever abnormal. The labor itself was easy and in nowise remarkable.

At first glance the right foot appeared to me like a severe pes varus. The physician attending the mother at birth had called it an ordinary club-foot, and it was sent to me as such. A more careful examination, however, at once excluded the diagnosis of pes varus; it showed the tarsus and bones of the foot very slightly, or not at all, deformed. If the leg were grasped just above the malleoli it could be seen at once that, from the tibio-tarsal articulation down, the foot was almost normal in shape. Movement in the tibio-tarsal articulation was perfect and pronation of the foot extremely easy. On examining the foot from its plantar aspect, however, it could be noted that the middle line of the sole curved slightly inward, and, what is more important, that the right foot was about three-fourths inch shorter than the left. It was now evident that the principal deformity lay not in the tarsus or foot itself, but that it must be sought for in the lower ends of the tibia and fibula. A very thick panniculus prevented the examination of the leg from being easy, but there was no difficulty in outlining both external and internal malleolus with the finger. The diaphysis of the fibula could be outlined in its lower portion, though with some difficulty. The examination further made it evident that the joint surface of the tibia was slanted from below upward and inward. Both tibia and fibula, therefore, were bent inward just above the malleoli at about the epiphyseal line of the tibia. The astragalus was more prominent than normal on the outer side of the foot, and over it was visible a small dimple in the skin similar to those sometimes seen on the convexities of true club-feet. Nothing could be felt in the tibia or fibula to remind one of callus formation. The diagnosis of intra uterine separation of the tibial epiphysis was made. In

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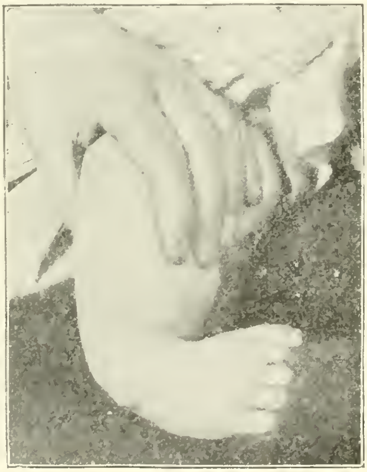
[1] Ohio Medical Journal, September, 1894.



Congenital deformity at ankle.

this way I accounted for both the deformity of the leg and the shortening of the foot.

While I could not hope to prevent increase of shortening in the foot and leg, I expected to bring the foot around in order that the child might learn to walk, and with this purpose I operated on April 19, 1894. An incision over the inner aspect of the tibia above the malleolus enabled me to reach the point of bending in this bone, and upon its being exposed a slight thickening of the bone could be felt. The tibia was here cut through with the chisel. At a point somewhat higher up I did cuneiform osteotomy of the fibula through a second incision. The foot could now be straightened easily although it remained in equinus position to a slight degree. An immobilizing dressing was applied. By April 28 the wounds had entirely healed, and on June 6 I made tenotomy of the tendo Achillis. On July 10 the child was able to bear his weight on the foot. The leg was about one inch shorter than the left. August 15 the child was brought to me walking quite well with a high shoe.

During the winter it became apparent to the mother that the foot was again turning inward, and by February, 1895, the deformity was almost as bad as in the beginning. I assumed that inasmuch as the osteotomy in the fibula was above the epiphyseal line, the growth of the fibula soon exceeded that of the tibia, and the foot was again turned inward. In May, 1895, the mother informed me that the child had died from meningitis after an illness of three days. I was unable to secure an autopsy.

This case seems to me interesting for several reasons. Were intra-uterine fractures in and of themselves not sufficiently infrequent to warrant a report of each case, I think the case under consideration would still claim some attention. It is estimated that about 50 per cent. of all reported intra-uterine fractures are fractures of the leg, and of 16 of the latter cases collected by Ithen,[1] up to 1885, only two were in the region of the lower epiphysis. Of 33 cases of various intra-uterine fractures collected by Gurlt[2] in his classical article on this subject only one could be regarded as an epiphyseal separation. With regard to its etiology our case is equally interesting. Ten of Ithen's 16

[1] Intrauterine Unterschenkel Brüche Einsiedeln, 1885.

[2] Lehre von den Knochenbrüchen, Berlin, 1862.

collected cases were due to trauma during pregnancy, while five of the remaining six cases are uninvestigated in this regard. In our case the intelligence of the mother compels me to discredit the possibility of her having received any trauma of importance during her gravidity. Neither is it possible, in my opinion, to ascribe the condition to any constitutional disease or to disease of the bones in general. The parents of the child as well as their other children are perfectly healthy save the deformities of sister, father, and grandfather before mentioned. I must confess myself entirely in the dark as to the mode of production of this deformity.

In the greater number of reported cases of intra-uterine fractures of the leg there has been incomplete development of the foot with absence of toes or even of metatarsals. In our case the foot is simply shortened, as is likewise the leg itself. Both of these are the usual conditions in intra-uterine fractures of the leg. In a considerable number of instances the fracture has been compound, shown either by a wound still unhealed at birth or by a cicatrix over the seat of fracture. I am unwilling to ascribe this meaning to the dimple on the outer side of my patient's foot, as it was neither in the right place nor was it a true cicatrix.

The character of the deformity, simulating, as it does, true club-foot, seems to me the most interesting feature of the case, and having ruled out pes varus there was still some difficulty in making the diagnosis. Volkmann was the first to describe a peculiar condition which he called "congenital dislocation of the ankle-joint."[1] This condition, which has since been given the more apt name of "Volkmann ankle deformity," consists of a congenital deformity of the lower ends of the tibia and fibula, causing the joint-line of the ankle to slant from below outward and upward, the normal being almost horizontal. In the cases of this deformity reported by Bidder, Burckhardt, Riedinger, Fahr, and others the foot has been normally developed. A case has also been reported by Burckhardt where the condition was said to be similar to those above mentioned, excepting that the joint-line ran from below upward and *inward* instead of outward, and our case corresponds somewhat with the description there given. The retarded growth of the foot in our case seems to me an important factor weighing against this condition, and favoring the diagnosis of intra-uterine fracture at the epiphyseal line of the tibia. Ithen[1] gives a careful analysis of the case of so called congenital luxation, reported by Fahr,[2] and shows this case to be far more likely an intra-uterine fracture of the lower end of the tibia. Save the defective development of the fibula in this case it bears much resemblance to our own, being simply an inverse form of the deformity. In our case the fibula was certainly normal at its lower end ; this could be noted at the operation.

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[1] Hoffa Orthopädische Chirurgie, 1891, p. 623.

It is to be regretted that the early death of our patient prevented further observation. It will be noted in our case that ten months after the operation the deformity had recurred to almost its original extent. As I have said, I believe this was due to the difference in growth between fibula and tibia, and on this account I am inclined to think that it would have been unwise to attempt further correction of the deformity during the period of active growth. At the end of this time, osteotomy of the tibia and resection of a portion of the fibula might have been expected to permanently straighten the foot, and make possible walking with the aid of a very high shoe.

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[1] Loc. cit., p. 17.

[2] Congenit. Sprunggelenkluxat., Inaug. Dissert., Halle, 1884.

# A CASE OF CONGENITAL SUBSPINOUS "DISLOCATION" OF THE HEAD OF THE HUMERUS.[1]

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CONGENITAL displacement or "dislocation" of the humeral head is either uncommon or frequently overlooked. The condition is probably a malformation similar to that which exists in the so-called congenital dislocation of the hip. The subspinous or subacromial variety, to which the present case belongs, is said to be less frequently seen than the subcoracoid, which is the other form of displacement described.

The child was referred to me by Dr. C. H. Mann, of Bridgeport, Pennsylvania, who had delivered the mother at the time the child was born. He remembers nothing particular about the labor, but the mother says it was a difficult one and that instruments were used.

When the baby was three days old the parents noticed that the left arm hung at the side with the palm turned differently from that of the other hand, and that there was "a groove in the skin a little below the shoulder as if the arm had been turned the wrong way." The infant used the fingers to grasp things, as it did those of the other hand, and no diminution of strength was observed. There was no discoloration about the shoulder at the time of birth, and the child gave no special indication of pain at the shoulder when it was handled.

At the present time the patient is an intelligent, well-developed girl of ten years of age, with no other deformity than that of the left shoulder.

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[1] Read by title at the meeting of the American Surgical Association, 1895.

As is seen in the cut, taken from a photograph, the head of the left humerus lies beneath the outer portion of the spine of the scapula, causing a very marked prominence. It seems to rest just behind the posterior edge of the glenoid cavity, below the junction of the base of the acromion with the scapular spine. The humerus is abducted, and so greatly rotated inward that the posterior surface of the bone presents outward instead of backward. This rotation causes the back of the elbow to point outward and the articular surface of the head of the humerus to present almost directly backward.

There is a depression on the anterior surface of the chest below the outer end of the clavicle and the tip of the acromion ; the general contour of the upper part of the arm and the shoulder in front is changed. The shoulder is flattened or less square than normal. This is due partly to the changed relations of the bones and partly to muscular atrophy. No deformity exists in the clavicle. Neither the acromion or coracoid process is unduly prominent. In fact, the latter seems less prominent than on the normal side of the body. This does not accord with the case reported by R. W. Smith in which the coracoid process caused a remarkable projection.

The scapula seems to occupy a higher position on the left side than on the right and moves with the humerus, for there is little mobility at the shoulder-joint. The distance from the head of the humerus to the tip of the olecranon seems less in the abnormal than in the normal limb.

When at rest the left arm hangs at her side, farther from the chest than on the right side, and with the forearm in pronation. The child can voluntarily increase the pronation ; but has very little power to supinate. She can flex and extend the elbow freely, but complete extension is impossible. The movements of the wrist and fingers are normal.

When the surgeon rotates the upper arm the moving humeral head gives a grating sensation to a hand placed over it. The movements at the scapulo-humeral articulation are much restricted. The abducted arm can be brought into contact with the chest by pressure, but the child cannot voluntarily bring it into that position. Full extension of the elbow cannot be obtained, but passive pronation and supination of the hand are perfect.

There is muscular atrophy of the arm and some atrophy of the muscles of the forearm. When the child wishes to put the left hand on the right shoulder she has to throw her arm upward with a sudden movement which carries the elbow outward. She is then able to put the tips of her fingers upon the right shoulder. Subsequently, by a sort of creeping motion of the fingers, she succeeds in drawing the hand on top of the shoulder. After thus grasping the shoulder she can bring the humerus, elbow, and forearm into contact with the front of the chest.

She can bring the arm and elbow into contact with the left side of the head, but cannot put that hand on top of the head. If, however, the elbow and forearm are passively raised, so that the humerus becomes more or less horizontal, she can readily place her hand on top of her head. She says that she can arrange her hair, if she first uses her right hand to lift the left arm and hand in a similar manner into the position which allows her to place the left hand on top of the head.

I advised operation, and will, if permitted by the parents, cut down upon the head and excise it or put in contact with the glenoid cavity. Thus far I have been unable to gain their consent to any operative treatment.

# UNILATERAL LARYNGECTOMY FOR CANCER; NO RECURRENCE AFTER THREE YEARS.

By GEORGE H. MONKS, M.D.,

OF BOSTON.

THE patient, whose photograph accompanies this communication, I operated upon for cancer of the larynx on May 17, 1892.[1] The cancer (epithelioma) was confined to the right half of the larynx; and this half was removed entire, after preliminary tracheotomy had been done. Since recovering from the immediate effects of the operation the man has enjoyed good health, has been able to do his full work, and to speak intelligibly. There has been no sign of a return of the disease. The photograph was taken on May 17, 1895,—just three years after the operation. The patient still wears a tracheotomy-tube most of the time, as it is feared that, if he should discontinue its use, stenosis at the site of the operation might result, and thus embarrass his breathing. In the upper part of the tube is an opening which allows the air to pass to and from the mouth. The tube has been very carefully made for the patient by Dr. Kirk A. Garland, dentist, so that it fits with great accuracy. This is especially true of the shield, which has been shaped upon an exact mould of the contour of that part of the neck which surrounds the opening. The tube is held in place by tapes in the usual manner. The patient ordinarily wears a cork in the outer opening of the tube, so that almost all the air to and from the lungs passes through the mouth. It is extremely interesting to notice how easily the man can talk and make himself understood with only one vocal cord. A few days ago he talked with me over the telephone, and I was able to understand all he said without the least difficulty. As non-recurrence for so long a time after operation seems, in these cases of laryngectomy, to be quite rare, the report of the present condition of this patient has added interest.

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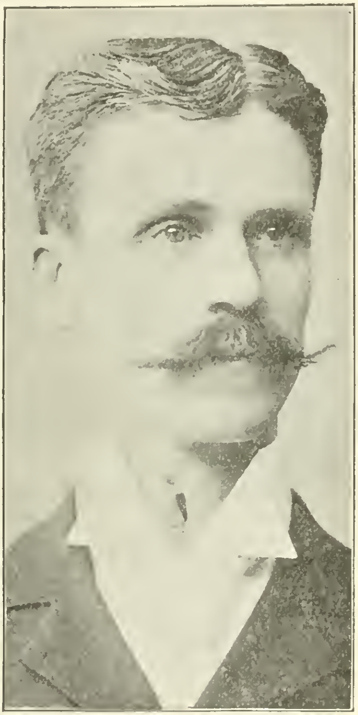
[1] The case was reported in the ANNALS OF SURGERY of July, 1893, with full details as to the operation and clinical history up to that time.



Monks's case of unilateral laryngectomy for carcinoma.
Condition three years after operation.

# TWO CASES OF BONE-GRAFTING FOR CRANIAL DEFECT.

By BURT LEANDER EASTMAN, M.D.,

OF BURLINGTON, KAN.

CASE I.—This case was treated in Cook County Hospital, Chicago. J. B., male, forty years old; history as follows:

Eight years ago was kicked by a horse, sustaining a compound comminuted skull fracture, involving part of the left half of the frontal bone. The wound suppurated, was a long time healing, and all the loose fragments sloughed out or were removed by the physician, leaving the injured area covered only by the skin. From that time this region has been pulsating, tender at all times, and at intervals the seat of a throbbing headache so severe as to disable him for days at a time. Within the last three years this periodical headache has grown so much worse that the patient is incapacitated from earning a livelihood on account of it. Four years ago he began to have what he called "blind spells," which grew slowly worse and finally developed into epileptic convulsions. These appear irregularly, seldom oftener than once in three weeks. While the patient is positive that he has these attacks, he makes little complaint, saying that if he could get rid of his headache, and the hole in his head would stop "beating," he would be very comfortable, even with the fits. He notices no aura, and close questioning fails to elicit anything in the onset or progress of this trouble that could be classed as a focal symptom. While in the ward he had one attack which was not seen by physician or nurse at the time, but was described as a "fit" by other patients.

*Examination.*—A large irregular scar three inches long in left frontal region, two inches above external angular process. Under the scar is a sunken area, one by three inches, in which the bone is lacking, the bottom being soft and pulsating visibly. Skin thin and adherent to underlying tissues and the whole area slightly tender to pressure. Examination of eyes, face, or limbs fails to show any paralysis, paresis, or spasm of any muscle or set of muscles. The case was explained and patient readily chose the risk of the operation for the chance of being relieved of his almost constant headache and the perpetual throbbing in the defect.

*Operation.*—September 30, 1893, after twenty-four hours' application of soap and carbolized dressing to shaved scalp.

Ether; strict aseptic preparations; horseshoe incision five inches long and three wide, base at parietal eminence; apex one inch above left orbit. Skin dissected away from edges of gap in the skull and from underlying dura, and the flap turned back out of the way. The dura was then well loosened from the edge of the defect, opened, and loosened from cortex beneath. Then a pattern of the gap was cut from sterilized rubber tissue, placed on the bone adjacent, and marked with a chisel. With this as a guide, the incision was carried down to the diploë, and a piece of bone cut from the outer table and pried off. This was two and three-quarters inches long by one and a half wide at its middle, and nearly oval in shape. The graft fitted quite well, although of a little different curvature, and with some trimming it filled the defect nicely, the periosteum being taken with it.

The flap of scalp returned to place, drained with silk strands, and sutured. The operation was prolonged and rather bloody; little shock.

Wound healed by first intention; stitches removed on seventh day. Patient left three weeks later, and was lost sight of, and since then has never reported to the hospital that I can learn. When he left, the previously sunken, tender, and pulsating area was even with the adjacent scalp, and filled with firm bony structure. His headache had vanished and the pulsation was also gone; patient declared himself well.

CASE II.—S. G., farmer, aged twenty-four years. History: Seven years ago he received a shot at close range from a heavy calibre pistol, the bullet entering the left frontal region two inches above external angular process, and emerging from the right cheek just in front of the ascending ramus of the lower jaw.

Considerable brown matter oozed from the skull-wound during the next forty-eight hours, and there was considerable hæmorrhage from the nose, and of course from the mouth. A few spiculæ of bone were removed from the wound at the time, otherwise no interference. Both wounds healed in about three weeks, and patient was apparently as well as ever. It is difficult to understand how the bullet missed both orbits and both optic nerves, but the patient has had no disturbance of vision whatever.

In 1893, five years after the injury, patient began to have attacks of vertigo, which speedily developed into epileptic convulsions. Two months after their appearance the site of the wound was trephined by an operator in a large Western city, and a one-and-a-half-inch button removed with the old perforation as a centre. This had been filled in with fibrous cartilage so thin as to be translucent. There was some roughening of the edges, and the operator said he also removed a spicula of bone which had been embedded in the dura. The wound healed nicely, except that a small abscess appeared in the scar three weeks later, and patient remained healthy and free from his epilepsy for sixteen months. Then the attacks recurred again, and soon became worse than ever. I saw him first in March, 1895. He was having the seizures at intervals of two or three weeks. each one lasting from six to thirty hours, during which time he had from three to eight convulsions.

Patient is a heavily-built, well-muscled man, quite intelligent, and not at all of a nervous type.

Two inches above and one inch behind the left external angular process is a stellate scar, two inches across, and beneath it is a circular depression, apparently one inch in diameter, with quite abrupt edges. Very slight tenderness in the scar; the bottom of this area is soft and pulsates visibly. Skin thin and adherent to edge and floor of the depression. Depressed and adherent scar in right cheek below malar bone, immediately in front of ascending ramus of the jaw. Convulsions as stated above; no headache; no eye symptoms; no paralysis.

Family history is that an aunt had convulsions from infancy, and is supposed to have died from this in early adult life.

Patient was put on moderate doses of bromides in two combinations, and the dosage increased as the stomach tolerated it until the characteristic eruption appeared. The seizures appearing as before, the bromides were pushed until the stomach, as well as the patient, rebelled.

Patient became discouraged after five months' medical treatment and demanded more radical measures, the success of the first operation convincing him that his relief must come, if at all, by another operation.

Assuming the case to be of traumatic origin, the intended operation was explained to patient and parents, with the attendant danger to life. No assurance was given of permanent or even temporary cure, but was accepted without delay.

Operation July 8, 1895. Soap and carbolized dressing previously applied to shaved scalp for twenty-four hours. While on the table, being cleaned up and awaiting the anæsthetic, patient had a typical moderately severe convulsion lasting probably half a minute. This complicated matters, but it was decided to go ahead. Ether well taken, but once during the operation there was a short period of apnœa with a very slight tremor of the muscles, and a marked darkening of the blood; this was taken to be another convulsion, masked and controlled by the anæsthetic. A horseshoe flap raised almost the same as in Case I, but smaller, and extending to left eyebrow.

Skin dissected from skull and dura and flap turned back. The dura was thoroughly loosened from the edges of the defect, then opened, and loosened from the cortex. From the dura was removed a large iron-dyed silk ligature from the previous operation. Cortex bled freely, but the cicatrix could not be defined by any difference in color or consistence, hence no cortex was removed. With a one-and-a-quarter-inch trephine a button was cut from the outer table just behind the old wound. This was reversed and placed in the defect with the pericranium on the dura, and its rough surface from the diploë next the skin-flap above.

It was expected there would be some ingrowth of bone in the old trephine-wound and that a one-and-a-quarter-inch button would be fully large enough. This was not the case at all, and the transplanted section did not fit as snugly as might be wished. Hæmorrhage from cortex and diploë arrested with hot water and pressure. Flap sutured in place and silk drain left at its apex.

In the whole operation the hæmorrhage was profuse, prolonging the work considerably, but there was very little shock. During the next thirty-six hours he had five convulsions. Wound healed nicely except at the apex where the edges separated slightly, this possibly from tossing about in his convulsions. Stitches removed on seventh day; dressing worn for another week. One month later the bone is firm, immovable, and no pulsation visible or palpable, depression is very slight, not much greater than the difference in thickness of the scalp and old attenuated scar.

Patient felt well and in the best of spirits, beginning to feel free of the dread of his malady up till three days ago, nine weeks from the operation, when convulsions recurred, fully as severe as before, having six in eight hours.

*Remarks.*—So far as the epileptic element is concerned, the results in these cases are not encouraging. The value of Case I is negative, owing to the entire lack of subsequent history, a condition which is common in hospital cases.

In Case II the result is discouraging, not being equal to that obtained from the previous operation two years before, and might be well criticised. But, leaving the epilepsy out of consideration, these cases illustrate a method of filling bony defects in the skull which to me seems better in many ways than that of using silver, lead, celluloid, or tin-foil plates, or rubber tissue. This natural plate is far more likely to remain in place without suppuration, and in any case affords as good protection as the others.

When the healing is aseptic and the transplanted plate becomes apparently a part of the contiguous skull, the result is certainly ideal, both in affording protection to the underlying soft tissues and in its cosmetic effect.

What is the ultimate fate of such transplanted bone? Does it remain in the tissues as an aseptic, non-irritating foreign body liable to be absorbed at any future time, or does it become vitalized and resume its life and function as bone, again to remain bone and nothing else?

# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, October 9, 1895.*

The President, Robert Abbe, M.D., in the Chair.

## THYROIDECTOMY FOR EXOPHTHALMIC GOITRE.

Dr. William B. Coley presented a woman, aged thirty-two years, upon whom he had operated at the New York Cancer Hospital, on April 6, 1895, for a well-pronounced goitre associated with exophthalmos and rapid heart-action. The pulse before operation ranged between 100 and 110. The dyspnœa was very great, and the slightest exertion caused a feeling of suffocation. The patient could speak only in a whisper.

The operation consisted in removing the entire left half of the tumor and closing the wound without drainage. The hæmorrhage was considerable and difficult to control. A large number of ligatures were used. The patient's condition was critical for a time after the operation, with marked acceleration of the pulse and respiration.

The portion removed measured four and a quarter inches by two inches, and weighed three and a quarter ounces.

Microscopic examination showed the tumor to be a cystic adenoma of a highly vascular type.

The wound healed by perfect primary union, and recovery was rapid.

Her voice has become quite normal, her dyspnœa has entirely disappeared, her exophthalmos is less marked, and her heart-action less rapid.

Dr. Fred. Kammerer said that while some surgeons had seen no bad effects after thyroidectomy, others, like Kocher and Mikulicz, had seen some very serious results from operative interference with exophthalmic goitre. Dr. Kammerer had himself, at a former meeting of the Surgical Society, reported two fatal cases, the only ones of quite a number of thyroidectomies. In one the four thyroid arteries were tied; in the other the entire gland was removed with the exception of that portion supplied by one of the inferior thyroid arteries. In both cases the pulse and respiration began to increase very soon after the operation, the former becoming very rapid, and finally averaging more than 200 beats. Both patients died within fifteen hours, careful dissection in the case of ligation showed that no unintentional damage had been inflicted on neighboring tissues, such as nerves. Owing to this experience, he would be very cautious about attacking these cases, and other surgeons, he believed, had had similar experience. The operation itself was not more difficult, from the fact that we were dealing with an exophthalmic goitre, but the difficulty here also was dependent on the variety under observation (vascular).

He added that he did not think the dangerous or fatal symptoms alluded to depended upon the hæmorrhage. In his first fatal case he made a careful post-mortem examination. thinking he might have ligated a nerve, but found that he had not. The operation had been a clean and relatively easy one. Kocher, who had published a thousand cases of goitre, had warned us of the liability of such symptoms arising after a clean operation in exophthalmic cases.

Dr. A. J. McCosh remarked, as to the amount of hæmorrhage in such operations, that in a case operated upon by himself six months before, a great deal of blood was lost during the excision of the tumor, and afterwards the bed from which the gland had been removed continued to ooze blood very freely. As it was impossible to control the hæmorrhage by ligature, packing was employed. The pulse had varied before the operation between 145 and 155. About five months subsequently it had fallen to 100, the patient had gained seventeen pounds in weight, was no longer breathless, the exophthalmos had disappeared, and she showed great improvement from the operation.

He referred to a medical meeting at which he had shown this patient, and at which eight deaths were reported as having occurred from thyroidectomy in cases of exophthalmic goitre in New York City during last year, and all in the practice of the ten men who were present at the meeting.

Dr. B. F. Curtis said that another feature of danger after operation for exophthalmic goitre was great rise of temperature with certain cerebral symptoms, ending in one of his cases in death. Dr. Starr, who had seen the patient, thought the symptoms resembled those of over-feeding with thyroid gland tissue, and suggested that they were caused by absorption of thyroid material in the wound. Two other patients operated upon by him recovered, and had shown permanent relief of symptoms. The operations had not been particularly bloody, and there had not been more cardiac depression than in ordinary goitre cases. In one of the cases which recovered there was a rise of temperature during the first twenty-four hours, with no signs of sepsis. Sepsis was also entirely absent in the fatal case. There had been a slight nephritis, but it was not worse after the operation, and would not account for the rise of temperature, although it might account for the nervous symptoms.

Since Dr. Starr had suggested absorption of thyroid material as the cause of such rise of temperature, he had looked for it in cases of ordinary thyroidectomy, and had seen something similar in one case. He was not sure, however, but that slight septic infection might in this instance have been the cause of the rise in temperature, or possibly there had been some iodoform absorption in this case, but in the other two cases iodoform was not used.

## GASTRO-ENTEROSTOMY WITH MURPHY'S BUTTON.

Dr. Charles K. Briddon presented a man, fifty years of age, upon whom, June 19, 1895, he had performed gastro-enterostomy with Murphy's button on account of carcinoma of the pylorus. There was apparently complete stenosis of the pyloric orifice, and consequent great emaciation.

An incision four inches in length was made transversely across the epigastrium, the peritoneal cavity was opened, and stomach presented in the wound. A cancerous growth was easily felt, involving the pylorus and first part of the duodenum. The omentum and peritoneum, as far as could be made out, were not involved.

The omentum and colon were raised up, the lesser peritoneal cavity opened by blunt dissection through the mesocolon. The stomach was rotated forward and upward on its long axis, thus exposing its posterior surface. The jejunum was then looked for and found without difficulty. This was followed up to a point near its junction with the duodenum. An intestinal suture was placed in the jejunum at this point, including all of its coats in the form of a purse-string. An incision was made at a point within the purse-string, and the male portion of a Murphy button inserted and tied in position by tightening the purse-string suture.

A point on the posterior surface of the stomach was similarly treated, the female part of the button being inserted. The two parts of the button were then united, and excellent apposition obtained.

The abdominal wall was closed by a single layer of silkworm-gut sutures. An uncomplicated convalescence followed. The button was passed *per anum* on the thirteenth day afterwards. Since the operation the patient has increased in weight and strength.

## INTRAPERITONEAL RUPTURE OF THE BLADDER.

Dr. Charles K. Briddon read the paper upon this subject, for which see page 706.

Dr. B. F. Curtis thought the suggestions of the author with regard to draining the bladder by catheter or through the perineum were in accord with prevailing practice, but it seemed to him unnecessary. Wounds in the bladder would heal well enough if the viscus were allowed to evacuate itself at stated intervals, or if the fluid were drawn off by urethral catheter regularly. This had proven true in some cases of suprapubic section and suture of the bladder performed by him, and the results had been very good. Recently, in looking up the question of wounds of the bladder during operations for hernia, he had found about twenty cases in which the details of the treatment were given, the number of cases in which catheter drainage was carried out being about equal to those in which it was not. The percentage of cases in which primary union was obtained was about the same in the two classes. Of course, if the catheter were not left in the bladder, some means would have to be taken to prevent the organ from becoming over-distended. Some surgeons used a catheter at regular intervals, while others simply had the patient evacuate the bladder every two or three hours. Dr. Curtis thought that this was preferable to draining the viscus, and it certainly showed that it was not necessary to drain through the abdominal wall.

Dr. Briddon replied that the criticism made by Dr. Curtis did not apply to the cases in question, for there was a pronounced difference between suprapubic section of the bladder communicating with the outer world and a rent in the wall of the viscus communicating with the peritoneum. In suprapubic section of the bladder it was practically immaterial what one did with the wound, or whether the line of suture healed or did not heal, as no mischief would result. In intraperitoneal rupture the wound was fraught with immediate danger. He would not like to subject his patient with intraperitoneal rupture to the danger of the sutures giving way from distention of the viscus.

Dr. Curtis rejoined that where the wound healed primarily, there was no danger of peritonitis, whether it were intraperitoneal or extraperitoneal. In fact, he thought it was easier to get primary union in a wound of the peritoneal surface. It was only necessary to see that the bladder did not become overfilled. Of course, if the wound leaked and urine entered the peritoneum, the patient would die, but he thought that wounds closed in the careful manner described in the paper would heal by primary union, and that it was an advantage not to be compelled to drain the bladder also in cases in which it was necessary to drain the peritoneal cavity.

Dr. Hotchkiss said that during the past summer, while operating in a case of tuberculosis of the peritoneum and bladder, he had accidentally made a small wound into the posterior wall of the bladder and closed it by sutures. No provision was made for drainage except that the catheter was passed at moderately frequent intervals. The wound healed primarily, but reopened after about ten days, as he supposed, because of breaking down of the tubercular walls. It had become shut off, however, by adhesions and closed later without interference on his part. He also remarked that the final result in cases of rupture of the bladder was much influenced by the length of time which intervened between the accident and the operation. It seemed to him that the patients had died of peritoneal sepsis, independent of drainage of the bladder or peritoneum, the absorption of septic material before the operation being sufficient to determine the fatal result.

Dr. Briddon said that the case related by Dr. Hotchkiss was quite different from one of extensive rupture. It was a small wound, and the probabilities were that it would have done no harm if left open. It seemed that almost anything could be done with a tubercular peritoneum and the patient would get well. He recalled a case which he had reported ten or fifteen years ago. He was called to Long Island to operate on a child supposed to have appendicitis. It was *in extremis;* the lips were retracted, the teeth and mouth were covered with sordes. He felt a tumor at one side of the median line, and on opening the abdomen by artificial light, a cyst bulged into the incision, into which a free incision was made, and it was then discovered that he had opened the bladder; he did nothing with it, did not even sew it up, and the child got well.

As to intraperitoneal ruptures of the bladder in general, he was under the impression that in cases in which an autopsy had been made the sutures were found to have yielded in a good many. One was apt not to get primary union. It was quite different in clean incised wounds. In rupture there were ragged, bruised edges, which had been soaking in urine some hours before being sutured, a condition not very favorable for primary union. He certainly would feel safer with a catheter introduced through a perineal opening ; it complicated the case but little, and the patient would probably prefer it to repeated introduction of a catheter through the urethra. But the point which he would again specially emphasize was the necessity for operating, if possible, immediately after the accident,—not wasting time in waiting for symptoms to confirm the diagnosis.

## ECTOPIC GESTATION.

Dr. Briddon presented specimen of fœtus and its adnexa, removed by operation in a case of extra-uterine pregnancy, with the following history: The woman, who was twenty-eight years of age, had borne one child six years before. Had had no miscarriages until during present illness, which dated back ten weeks previous to her admission to hospital. She then had an attack of pelvic and lumbar pain, followed, two days later, by hæmorrhage from the uterus, which continued until, at the end of two weeks, she aborted a two months' fœtus. Since then the pain in the back and lower abdomen still continued, becoming remittent in character and most marked on the right side. For four weeks she had painful and difficult micturition. Has lost flesh and strength, while abdomen began to increase in size.

Pelvic examination revealed a large, slightly tender, firm mass behind the uterus which about filled up the cul-de-sac of Douglas.

Upon opening the abdomen a large, soft uterus was exposed with small intestine adherent to it. After tearing adhesions, a large, bluish-black mass was seen behind and to the right of the uterus. On still farther separation of adhesions it was found that the mass on the right extended as well towards the left. This mass was opened and a large quantity of dark fluid blood with some clots escaped. Soon bright blood appeared, and the only way the hæmorrhage was stopped was by rapid separation of the placenta, which was found engrafted high up, almost to the liver. A fœtus of apparently about four months' development was found in the sac.

An aseptic, plain gauze tampon was introduced to the very bottom of the pelvis. Few silkworm-gut sutures in upper part of wound. Rest left open. On account of threatening collapse an intravenous infusion of Oiss normal salt solution was made. Improved at once; her condition remained bad for a day or two, when she began to improve, and after that recovery was uneventful.

## ARTHROTOMY FOR IRREDUCIBLE BACKWARD DISLOCATION OF ELBOW.

Dr. L. W. Hotchkiss presented a girl, nine years of age, whom he had subjected to arthrotomy, July 30, for the relief of an irreducible, backward dislocation of both bones of the forearm at the elbow which had been sustained five weeks before. The joint was exposed by a posterior, longitudinal incision three and a half inches long.

Above and behind the external condyle was a small shelf of new bone on which the head of the radius rotated. This was chiselled away and adhesions on radial side and around olecranon freed. A second incision was made over the anterior aspect of the joint and on the ulnar side, to expose the joint cavity anteriorly, and to allow easier division of certain bands which prevented reduction of the dislocation. The sigmoid cavity of the ulna contained some new-formed tissue which was cut away with scissors. After division of all the retaining bands and removal of a small portion of the tip of external condyle which had apparently been fractured at the time of the original injury, the bones were easily reduced and the wound closed without drainage. A plaster-of-Paris bandage over a sterilized gauze dressing fixed the elbow at a right angle.

Primary union of the wound under the moist blood-clot was secured. The elbow now has a fair range of flexion and extension, —*i.e.*, flexion to beyond a right angle and almost complete extension. There is slight lateral motility. The patient has a strong, useful joint, and the range of motion ought to increase materially under daily use.

## TREPHINING FOR SUBDURAL HÆMORRHAGE COMPLICATING SIMPLE COMMINUTED DEPRESSED FRACTURE OF SKULL.

Dr. Hotchkiss also presented a man, aged twenty-nine years, who was brought to the Manhattan Hospital, August 7, 1895, having fallen from the fourth story of a building to the ground, striking upon the left side of his head.

On admission to the hospital, immediately after the accident, he was in a condition of moderate shock. His pupils were slightly dilated and he was almost completely unconscious. About a half hour later he was seen by Dr. Hotchkiss. He was then in a condition of stupor which was not complete. His pupils reacted slowly to light. His pulse was rather feeble. The extent of paralysis was not determined. Over the left parieto-temporal region of the skull the scalp was severely contused and infiltrated with blood, but there was no wound. There was a long gutter-shaped depression in the scalp running in an antero-posterior direction, and through this a slight depressed fracture of the skull beneath could be felt, but not distinctly.

By reflecting a flap, made by a large horseshoe-shaped incision over the left parieto-temporal region, the injured area of the cranium was exposed. A fracture was found running from the anterior portion of the left parietal bone and about an inch above its lower border, in a direction about parallel with the temporal ridge, but above it and passing backward and downward behind this ridge where it was lost upon the mastoid and could not be farther traced. Another fracture beginning at about the middle of the squamous portion of the left temporal bone and running across the line of fracture just described, at about a right angle, was lost at the vertex beneath the upper edge of the incision through the scalp. Radiating from the point of intersection of these two main fissures were numerous smaller ones extending into the parietal and into the temporal bone. There was a slight depression of a small triangular piece of bone at the point of junction of two main lines of fracture, but there was no wound in the dura mater beneath. The depressed portion was elevated, and a considerable opening made inside of skull with chisel and rongeur forceps, and the dura exposed. The incision in scalp was now enlarged by one running upward and backward from the posterior limb of the horseshoe, and a much better exposure of injured area obtained. In gnawing away the edge of bone with the forceps a large piece of the left parietal, which was partially detached between, came away. It measured about two inches in length and nearly one and a half inches in breadth, and was marked on its inner surface by the grooves for the anterior and posterior trunks of the middle meningeal artery.

The tearing away of such a large-sized fragment of bone exposed a considerable area of the dura, which protruded into the wound;

was very tense and blue and did not pulsate. A curved incision about two and a half inches long was made through dura, and exit given to a large amount of clotted blood and some brain tissue. The remaining clots were washed away with hot salt solution. The surface of brain exposed was much congested, and an area of laceration in what seemed to be the upper portion of the temporo-sphenoidal lobe was felt by the finger. As the patient's condition at this time was very bad, the dural wound was loosely sutured above, the lower angles being drained by strips of iodoform gauze, as there still seemed to be some oozing from the surface of brain. The edges of scalp wound were quickly brought together by a few sutures and the lower ends packed with gauze. A large, dry, sterile dressing was applied and patient put to bed. The operation was completed without the use of an anæsthetic.

The patient soon rallied from shock and showed marked improvement in symptoms. He passed a comfortable night, and next day was conscious and apparently cognizant of what was going on about him, but completely aphasic. There was right facial paralysis; tongue deviated to the left; eyes normal; slight loss of power of right arm and hand, and loss of muscular sense in fingers. Three days later he was in about same condition as regards speech, but could write his name, and seemed to understand what was said to him.

By September 6 the wound had practically healed except for a small sinus leading down to an opening in the skull, from which there was still some discharge. On dressing the wound this day one of the *internes* injected the sinus with some peroxide of hydrogen solution with the following results: As soon as the $H_2O_2$ was injected into the sinus the scalp seemed to become inflated and distended, and the patient suddenly became weak and faint, and he developed complete right paralysis of face and right upper extremity and some loss of power in right leg. The speech of the patient, which had been practically regained, became mumbling and unintelligible, and he was unable to articulate distinctly a single word. He experienced, also, intense pain over the left side of head. The condition of the patient was most alarming, and he was quickly put to bed. The pain in head was less by evening, and the next day was very much better. The loss of power of right leg quickly subsided, and the day after the accident he could move it fairly well, as well as the right arm slightly. The effects of this accident gradually subsided, and the general improvement before existing was regained. October 3, eight weeks after the original injury, he was discharged from the hospital with normal speech, and with power in the right arm practically restored, but with persistent right facial paralysis.

# TRANSACTIONS OF THE SECTION ON GENERAL SURGERY OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA.

*Stated Meeting, May 10, 1895.*

Dr. O. H. Allis in the Chair.

## STERILIZATION OF CATGUT BY BICHLORIDE OF PALLADIUM AND BICHLORIDE OF MERCURY.

Dr. W. W. Keen described a method of preparing catgut which had now been in use in the Jefferson Medical College Hospital for over two years, with such excellent results that he ventured to publish it so that others might test it. He stated that Professor Coplin, Dr. Bevan, and Dr. D. Braden Kyle had tested the catgut several times at his request and had found it perfectly sterile. He had made no experiments to determine its absorbability, but inasmuch as its clinical use in, perhaps, 300 or 400 cases had not shown any disaster due to non-absorption, it had seemed to him superfluous to make any such experiments upon animals.

He disclaimed for himself any part in originating it. It had been entirely the work of John Johnson, a helper in the clinic.

The method of preparation is as follows:

The catgut that is used is the *raw* catgut, not that prepared by boiling or heating, as is the case with much of that furnished by instrument-makers. The gut is first soaked in Squibb's ether (not the common commercial ether, which has sulphuric acid in it) for from twenty-four to forty-eight hours, according to thickness, in order to remove the fat. It is then placed in a solution of

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| Bichloride of mercury | 20 grs. |
| Tartaric acid | 100 grs. |
| Alcohol (95 per cent.) | 6 ozs. |

The catgut is soaked in this bichloride of mercury solution, according to its thickness, for a greater or less length of time. Dividing it roughly into three grades,—1, 2, and 3; 1 being the finest, 3 the thickest, and 2 that of intermediate thickness. No. 1 is soaked from five to ten minutes in the bichloride solution; No. 2, fifteen to twenty minutes; No. 3, twenty-five to thirty minutes. The bottles intended to contain the catgut are then made aseptic, both within and without, by washing in a $\frac{1}{1000}$ sublimate solution, and are then filled with 95 per cent. alcohol, to which is added two drops (about one-twenty-fourth of a grain) of the bichloride of palladium solution to the pint of alcohol. More than this small proportion of palladium precipitates. It is then kept permanently in these bottles.

Dr. D. Braden Kyle had tested the strength of this palladium catgut as contrasted with some tests of other catgut he made three years ago,[1] and had found that it was much stronger than the catgut prepared without the palladium. The finest can only be broken by a force greater than would ordinarily be used in tying small arteries, and the thickest can scarcely be broken by the utmost strength of the hands.

He had found it flexible, strong, and aseptic, the three most desirable qualities in catgut for surgical use. Any unused ligatures left at an operation are soaked in the mercurial solution again for three to five minutes and replaced in the palladium solution.

The bichloride of palladium solution can be obtained from a reliable firm of manufacturing chemists in Philadelphia.

## ILIAC AND FEMORAL ANEURISMS.

Dr. Thomas S. K. Morton exhibited a case of iliac and femoral aneurism cured by transperitoneal ligation of the external iliac artery, and also a case of popliteal aneurism cured by ligation of the femoral artery.

Dr. Joseph Ransohoff, of Cincinnati, remarked that in all aneurisms, after any operation, about 10 per cent. of the cases will recur; and they are more apt to recur where the ligature is applied to the continuity of the artery, especially where digital compression has been previously resorted to for any length of time, which increases the vascularity of the sac. Cases have been reported of popliteal aneurism in which, after five, six, or even fifteen years after the femoral was tied, pulsation in the tumor was resumed. He himself had had a case of cure of popliteal aneurism by ligation of the femoral artery, in which there is still a tumor in the popliteal space, and there may yet be a recurrence. Dr. Morton's second case is not unfavorably situated for the radical operation of removal of the sac. Possibly, it could be done now with less danger than two months before, at the time when the first operation was done. Of course, the radical operation seems more dangerous than the operation by simple ligation, on account of the dissection required to separate the sac from its adhesions to neighboring blood-vessels and nerves. But the difficulty is more apparent than real. If the surgeon is operating upon the axillary artery and clears out the tumor from the axilla, he may fear gangrene of the extremity; but no such result had followed this procedure in his experience. Also in cases affecting the popliteal artery, where both the artery and the vein have been tied in the operation, this result has not followed. In the course of the contraction of an aneurismal sac, some fibres of nerves may become involved, producing symptoms which may require amputation of the limb. This result will not follow total extirpation of the aneurismal sac.

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[1] Therapeutic Gazette, May, 1892.

Dr. John B. Roberts said that he had advocated the radical operation of extirpation of the aneurismal sac, although he had not himself done the operation of extirpation.

With regard to the first case presented by Dr. Morton he thought that the tying of the external iliac artery by the transperitoneal method to be much better than the old operation, by which one works in the dark, being guided only by the finger. He thought that the extirpation of the sac would be too radical for the cases which Dr. Morton had shown. The second case was to all intents and purposes cured. He may have a little dilatation hereafter, but he doubted if it would be a dilatation of the popliteal artery at the old spot. All know that, if the vessel is tied above the aneurism, any dilatation afterwards must be in the upper portion of the vessel, or somewhere in the neighborhood, and not, as one would be led to believe from Dr. Ransohoff's criticism, that there is a recurrence of dilatation in the old sac.

He operated a few years ago upon a man for popliteal aneurism, which was rapidly growing. He was cured of this, but returned a few years later with an axillary aneurism, from which he died. He saw also a case of Dr. Hearn's, in which there was an aneurism of the neck followed by others in different portions of the body.

Dr. W. W. Keen remarked that he had the pleasure of assisting Dr. Morton when he did the transperitoneal operation of ligation of the external iliac artery, and he could state that there was a great deal of sac at the time. Partly on account of the position of the vessel, and partly because the patient was in bed, the operation was done in the Trendelenburg position.

As regards the method of operating, he himself was in favor of ligation. In the second case, however, he was inclined to think it might be possible to adopt extirpation. It is a good operation, but there are cases in which he would hesitate very much about doing it as in the first case, where the sac extended into the pelvis and the operation might require division of Poupart's ligament. In such cases he would prefer the operation done by Dr. Morton.

Dr. J. M. Barton mentioned a case of ligation of the femoral artery for popliteal aneurism, which he did some years before at the German Hospital. It was in a man, and of traumatic origin. He returned two years later, with a continued fever, and was admitted into the medical wards as a case of typhoid fever. After a few days he was transferred to the surgical ward and again operated upon. This was five years ago, when the operation of excision was a novelty; but Dr. Barton started to do it in this case and found it a formidable operation, for the sac went beneath the ligament, and there were many adhesions to the vein. The patient made a good recovery and returned to his work at hard labor. He reports now that his leg gets tired when he stands for a time upon it; but he is well satisfied with the result. It depends very much upon the character of the case, of course, whether ligation or excision is the better operation to perform.

## CONSERVATIVE KIDNEY SURGERY.[1]

Dr. C. Fenger, of Chicago, called attention to the subject of the conservative surgery of the kidney as compared with nephrectomy.

Conservative surgery he thought to be useful and probably had a future in hydronephrosis. If it is possible to remedy the stenosis which causes this condition, it should be done, even in large sacs, in preference to extirpation. In 1885, the statistics of nephrectomy for hydronephrosis, according to DeJong, who collected fifteen cases with twenty-six operations, showed nine recoveries, five deaths, and one in which the result was unknown,—a mortality of 35.7 per cent.

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[1] Delivered by invitation before the Surgical Section of the College of Physicians of Philadelphia at a stated meeting held May 10, 1895.

This high death-rate was probably because the hydronephrosis forms a retroperitoneal tumor, and because the mortality following extirpation is affected by the size and location of the tumor, the larger the tumor the greater the risk, and the greater the difficulty in loosening the hydronephrotic sac from the many important organs in the retroperitoneal space. A large hydronephrotic sac, occupying one-half or more of the peritoneal cavity, has often been mistaken for an ovarian cyst. In thirteen such cases, cited by DeJong, extirpation through the abdomen was practised, often with almost insurmountable difficulties in operating. Smaller hydronephroses have been extirpated by the lumbar method in three cases with two recoveries and one death; but the size of most hydronephroses makes extirpation by the lumbar method impossible.

In August, 1894, Dr. Fenger opened a hydronephrotic sac from the lumbar region, which was so large that he could not reach either the upper or the lower end, and could not find the entrance to the ureter in the sac. After drainage for three months, the sac had so diminished in size that he was enabled, by a second operation, to find the ureter below, and to follow it up to the place of valve-formation at the entrance to the sac. The ureter was reopened by the operation for valve-formation, as described in my former article, and the lumbar wound closed without fistula in less than six weeks.

It thus seems advisable, especially in cases where an appreciable amount of secreting kidney tissue still exists in the hydronephrotic sac, to make lumbar drainage, and when the ureter cannot be found at this time, on account of the size of the hydronephrosis, to wait until the sac is so reduced in size as to permit the ureter to be found below and its patency re-established. By this procedure whatever secreting tissue remains is saved, and each of the conservative operations is less severe than nephrectomy,—that is, extirpation of the hydronephrotic sac.

There is another form of dilated kidney in which conservative operations are indicated as compared with nephrectomy. These are the cases of sacculated, suppurating kidney. In these cases there is only a moderate degree of dilatation; each of the many calyces is transformed into a sac which often has a narrow entrance, and in the partition walls between the sacs a variable amount of kidney tissue exists. The obstruction which causes the dilatation may be in the ureter or may, on the other hand, be in the kidney itself. In the latter case an entirely different method of operating is required, which I term "operation for stenosis in sacculated kidney."

The stenosis in the kidney may arise from a valvular arrangement of the partition walls between the sacs of the dilated calyces. such as the speaker described in 1873 in a paper entitled "Om den partielle Hydronefrose, oplyst ved et Sygdomstilfalde" (*Nordiskt Medicinskt Arkiv*, Bd. v, No. 12), in which he reported a case in which a partial hydronephrosis had formed in the upper half of the kidney above a valve of this kind. The requirement for this condition is an incomplete stenosis somewhere in the course of the ureter, which causes a moderate degree of multiple sac-formation over the whole kidney. At some point between a group of sacs and the dilated pelvis a valve now forms by reason of the excessive projection of one of the partition walls. This valve entirely closes off the distant group of sacs, and causes either local hydronephrosis and progressive dilatation of the excluded group, or, at any rate, renders the discharge of the contents from this group down into the pelvis impossible. It is consequently not sufficient to overcome the stenosis of the ureter alone, but it is necessary also to do away with the occlusion in the kidney itself.

He mentioned a case illustrative of this condition, and of the operation required for its relief. A young man with purulent cystitis, pyelitis, and dilatation of the kidney was operated upon in Philadelphia, in March, 1894, by drainage in the lumbar region, which left a fistula which discharged twenty-five to thirty ounces of urine in the twenty-four hours. Six months later Dr. Fenger operated with a view of making the ureter patent. He found a stenosis of the ureter at the entrance to the pelvis, made the usual plastic operation, and expected the fistula to close; but this did not take place, and the same amount of urine as before was discharged through the lumbar opening. Seven months later, expecting to find the ureter again closed at the seat of the former operation, or an independent obstruction in the kidney, he made a second operation with a view of overcoming the latter. After exposing the kidney, he divided it from the convex surface down into the pelvis into two halves. The partition walls between the numerous sacs were all separately divided so as to make the sacculated kidney one single cavity freely communicating with the pelvis. When he finally exposed the lowest portion of the pelvis, he found the ureter perfectly patent at the seat of the former operation. It was thus seen that obstruction caused by valve-formation between the sacs must have been the reason for the continuous discharge from the renal fistula. Four months later the bisected kidney was closed by suture, and at present the renal fistula has closed.

At the first glance it might appear that it would have been a much easier or shorter way out of the difficulties in this case to have extirpated the kidney; but this certainly would have caused the death of the patient, for between the first and second operations he had an attack of pyelitis in the other kidney, which placed the alternative of nephrectomy out of the question, and left no other course open except to save the kidney by re-establishing its connection with the bladder, if possible. If no pyelitis had been seen to exist, however, in the other kidney, the question of the permissibility of extirpating a kidney with a secreting capacity of thirty ounces in the twenty-four hours would be one for serious consideration.

A third instance, which demonstrates the value of conservative operating, he encountered in a case of tuberculosis of the kidney and stricture of the ureter in a man with hæmaturia, tubercle bacilli in the urine, and painful enlargement of the right kidney. He intended to perform nephrotomy or nephrectomy as the case might be, but found upon exposing the kidney that the tuberculosis was limited to the lower third of the kidney, which he resected, as the upper two-thirds of the kidney appeared healthy. He found the pelvis and ureter dilated, and at the vesical end of the latter a stricture which would not permit a sound to be passed down into the bladder. Sixteen to twenty ounces of urine passed daily through the lumbar fistula. The patient improved so much that, six weeks later, he operated upon the ureteral stricture by a suprapubic cystotomy and re-established the patency of the ureter. Two months later almost all the urine passed down into the bladder; but several months after the stricture of the ureter again retracted and urine was discharged through the lumbar fistula.

In case of tuberculosis, taking into consideration the uncertainty of the condition of the other kidney, it would probably be fatal to extirpate a kidney secreting as much urine as its fellow.

## THE CLICK OF POLISHED BONE SURFACES AS AN AID IN THE DIAGNOSIS OF OSTEO-TUBERCULOSIS OF JOINTS WITH LARGE SEQUESTRA.

Dr. Fenger said that since the introduction of the iodoform emulsion injection by Von Bruns in the treatment of tuberculous abscesses and tuberculosis of joints, excisions of joints have fortunately become comparatively rare. The marvellous effect of the iodoform emulsion to bring the tuberculosis to an end has not only saved many lives by the avoidance of the secondary infection which so often follows excision, but has also saved all the bone remaining in the tuberculous joint, and has thus given functional results far superior to those following excision. In consequence of this, it is only the severest cases of articular osteo-tuberculosis which do not respond to the iodoform emulsion injection, and in which resection finally becomes the operation of last resort. In the hip-joint, especially in adults, the prognosis is so grave that resection is very reluctantly resorted to. There are, however, cases in which the iodoform emulsion injection can be of no use; these are the cases in which extensive, primary osteo-tuberculosis has led to the formation of large tuberculous sequestra. In this class of cases the fate of the patient depends upon operation at the earliest possible moment when the diagnosis can be made. Not only does the tuberculous osteomyelitis extend into and destroy large territories of bone, or perforate through the acetabulum into the pelvis, but there is also greater liability to general tuberculosis in this severe class of cases.

In the early stage, exact diagnosis is generally impossible because both the light and the severe cases frequently commence alike, and it is not until later in the course of the disease when it is seen that, in spite of ordinary treatment, the severity of the symptoms persists or is aggravated, that extensive osteo-tuberculosis can be suspected, to be verified, however, only by ocular demonstration during the operation.

It is in this connection that he desired to call attention to a symptom—namely, the click of polished bone surfaces—which enabled him to make a positive diagnosis in the following case:

Case.—P. M., aged twenty-five years, entered Emergency Hospital January 19, 1893. Upon examination the right leg was seen to be slightly adducted and flexed, and exceedingly painful when moved. The patient holds it absolutely at rest with the other leg or hand. The right leg in corrected position shows one inch and a half shortening. On the outer anterior side of the femur in its upper third is a swelling extending from the anterior inferior spine of the ilium downward six inches to the second third of the femur. Rectal examination negative.

*Diagnosis.*—Tuberculosis of hip with abscess on outer aspect of femur.

*Plan of Operation.*—Evacuation of abscess and iodoform emulsion injection.

While the patient was being anæsthetized with ether the usual nervous tremor occurred, and a sound could now be heard all around the operating-table resembling the chattering of teeth, or the noise made by sliding a stick along the palings of a fence, or a cane in the spokes of a wheel in motion, or a woodpecker in a tree, as those surrounding the table variously described it. When the femur was moved with the hand a similar crepitation was heard, as when two eburnated surfaces are pushed together, a sound like the click of billiard balls.

This sound was suggestive of the presence of large, eburnated, polished, opposing bone surfaces, which signified large, embolic, polished sequestra both of the head of the femur and of the acetabulum.

The plan of aspiration and iodoform emulsion could not be carried out, as the pus was so thick and contained so many solid lumps that it obstructed even a large trocar. Incision of the abscess on the anterior upper and outer aspect of the femur was then made, and three or four ounces of pus mixed with solid shreds evacuated.

The abscess was scraped and found to contain large necrotic pieces of yellowish tissue as in diffused phlegmon. This signified destructive soft tuberculosis,—tuberculous diffused phlegmon. Two ounces of iodoform emulsion were injected through a canula inserted above the trochanter and the fluid came out through the abscess.

The wound over the abscess was hermetically sealed, and after the abscess cavity was thoroughly cleansed with tincture of iodine two ounces of the iodoform emulsion was injected.

Excision of the hip was postponed until the permission of the patient should have been obtained.

On January 26, the patient was again anæsthetized with ether, and Kocher's incision made. The margins of the wound were separated and the sciatic nerve pulled backward. When the capsule was opened, a mass of soft tuberculous granulation tissue or *débris* came out. Some difficulty was experienced in loosening the head and neck preparatory to the dislocation of the head of the femur. Upon exploration with the finger before dislocating the head, he felt a bone surface which he at first thought to be a fracture of the neck of the femur, the head being loose, but it proved to be sequestra in the acetabulum.

When the head of the femur was dislodged from the acetabulum, it was seen that the groove for the ligamentum teres was filled with tuberculous granulation tissue. Half an inch from the fossa, two white polished surfaces were seen, which were the bases of two sequestra, one of which was wedge-shaped, not loosened, but surrounded by a reddish area of bone in a state of granulation, which signified tuberculous osteomyelitis. The head was sawed through at about the epiphyseal line.

The acetabulum was almost entirely occupied by seven sequestra with polished surfaces, limited or surrounded by areas of red tuberculous granulation tissue. These were easily lifted out with a sharp spoon, only one of the sequestra being slightly adherent.

The wall of the acetabulum was now bony over its entire surface with no perforation into the pelvis. After curetting, a rather hard, firm, bone surface remained; at the upper posterior border there was a cavity half an inch in diameter and quarter of an inch deep which contained no sequestra, but was filled with soft or sandy cheesy matter, containing gravel of bone.

The capsule was excised with the knife and scissors, the bone surface cauterized with the Paquelin cautery, and tincture of iodine applied. The abscess wound was reopened, the cavity scraped and cleansed with tincture of iodine. The abscess wound was now packed with iodoform gauze and deep and superficial sutures inserted and provisionally tied. A plaster cast was then applied.

The patient died from general tuberculosis five months later.

Dr. Fenger met with a similar case of tuberculosis of the hip several months later in Mercy Hospital. Professor W. E. Morgan, to whom he had related his experience, in passing through one of the wards of the hospital, heard a similar clicking or chattering sound, and upon examination found that the patient from whom these sounds proceeded presented the same phenomena upon manipulation of the hip as were observed in the first case. The click could be heard all over the ward. Professor Morgan thereupon made his diagnosis, which was verified by the excision.

It is, of course, necessary that there be polished bone surfaces on both sides of the joint, and opposite to each other, in order to elicit this symptom; if, consequently, there is a large sequestrum on one side of the joint only the symptom is absent.

# EDITORIAL ARTICLES.

## GRASER ON THE ADHESIONS OF SEROUS MEMBRANES.[1]

The question of the processes in the healing of wounds will always be of interest to the surgeon. Every improvement in the histological technique in this line has been of great advantage; old ideas have been confirmed and new ones established. In recent times, new methods have been invented which have contributed very greatly towards advancing our knowledge of the living cell. Such methods have enabled us to follow the changes in growing cells by fixing the cells at any stage of their development for microscopical study. A key to the progress of development in the individual cell is found in the mitoses which can be fixed at any stage. The vital energy of the cell can be discovered by other means which show defects in its vitality, as the appearance of free fragments of nuclei within the cell, the changes in the staining capacity of the cell, manifested sometimes by an inability to take stains and sometimes by the appearance of diffuse staining.

One of the greatest advances made in this line was the fibrin stain invented by Weigert.[2] This consists in a staining with aniline-water-gentian-violet, and a subsequent decolorization of the stain, after fixing with iodine, with aniline oil, and xylol. By this method the tissues give up their color, while the fibrin remains an intense blue.

Another advantage of the method is that most of the micro-organisms which are present also remain stained. This must be regarded as a sort of micro-chemical reaction.

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[1] Verhandlungen der deutschen Gesellschaft für Chirurgie, XXIV Kongress, 1895.

[2] Fortschritte der Medicin, 1887, No. 8.

The material which first causes adhesion in wounds, and which was designated by Hunter by the term "gluten," and which, in more recent times, has been studied by Thiersch, Wywodzoff, Gussenbauer, and others, has been demonstrated by the method of staining conceived by Weigert to be fibrin deposited from the plasma of the blood.

The origin of this fibrin in the living body in inflammations and also in the dead state—*i.e.*, the coagulation of drawn blood—has been much discussed and disputed. The demonstrations made by Alexander Smith concerning the importance of certain fibrinogenous substances have been of great importance. He showed that there was constantly dissolved in the plasma of the blood a certain substance or substances which could be converted into fibrin by the action of a ferment which was liberated by the disintegration of the cellular elements.

By investigating this fibrin-formation and studying its *rôle* in the adhesion of wounds and serous surfaces in animal experiments, one observes the delicate fibrinous net-work which penetrates everywhere in the field of study and includes a variety of cells, some of which are in good condition and some in a state of inanition.

In a large number of observations, Graser found that fibrin was always formed between the edges of wounds and between adherent serous surfaces, and that this formation was greater in proportion to the increased degree of inflammation due to chemical or mechanical irritation, but that where suppuration occurred there was no fibrin formed either in the presence of pus or in its immediate vicinity.

The following experiment was made upon a dog: After opening the abdomen in the linea alba, the two halves of the abdominal wall were drawn up into a ridge so that the two peritoneal surfaces were opposed, and by the use of lead plates were held in this relation with sutures. After forty-eight hours there was an adherence of the peritoneal surfaces in many places. At other places the surfaces lay very loosely together, so that very gentle traction sufficed to separate them. Microscopical examination showed that at the places where there were firm adhesions there was a rich deposit of fibrin in the form of fibres and clumps, including many cells in their meshes. At the edge of this firmly adherent portion, at which the peritoneum was not adherent but formed a very small intermediary space, could be seen structures which gave an answer to the much mooted question. Not far from a place where the adhesions were firm was a small, free space between the two peritoneal surfaces. Here the endothelium of the peritoneum presented a very delicate border composed of nothing but delicate fibres studded with nuclear enlargements, the underlying endothelial cells being swollen.

In other places altered endothelial cells were found but rarely. Here and there were found holes where one or more endothelial cells were absent and which were filled with fibrin. Near such places were found others where there were no well-preserved endothelial cells, and where many of the cells appeared simply as swollen, unstained masses with scarcely discernible nuclei. These masses were dislodged from their normal ground and appeared in the space between the two layers of peritoneum.

Out of the large number of sections examined microscopically there was one class of especial interest, in which the endothelium was almost entirely gone and the ground membrane was covered with a layer of fibrin. In the middle, between the opposed peritoneal surfaces, was an amorphous deposit due to the coagulation of the albuminous inflammatory plasma by the process of hardening and fixing the specimen. It might be supposed that this plasma, which is so rich in fibrinogen, is the source of the fibrinous deposits. This has been found not to be the case.

The middle portion remained free, the fibrin fibrillæ radiating from the peritoneum inward towards the centre. At this place an active inflammation was not evidenced by an accumulation of leucocytes. Extravasated leucocytes were not present at all, or only in very small numbers. Nor were bacteria to be found anywhere in the field. The tissue was, however, œdematous, and the individual cells somewhat swollen and separated from one another by the serous transudate. The endothelium was undoubtedly damaged by interference with its nourishment, and presented marked differences from the normal tissue. This damage to the endothelium was not so pronounced as to be irreparable.

In the surrounding tissue a considerable amount of fibrin was found in the meshes of the connective tissue. In some places could be seen degenerating connective-tissue cells, surrounded by a thick layer of fibrin from which a delicate fibrinous net-work radiated out on all sides.

Before the peritoneal endothelium became firmly adherent it was found to undergo regressive changes. With the progress of these changes a deposit of fibrin takes place about these cells. When such fibrin net-work from the two sides comes together, adhesion takes place, while the cells which originally covered the surfaces continue in their process of degeneration.

Graser has already demonstrated that the interposed peritoneal endothelium perishes almost entirely with the adhesion of the two surfaces.

Judging from these researches, the thought occurs that the perishing endothelial cells have something to do with the formation of the fibrin. This must be conceded, but the fibrin itself is deposited out of the blood-plasma, the breaking-down cells furnish something which is, however, essential to the depositing of the fibrin out of the fluid plasma.

The investigations of Alexander Smith and his pupils showed that the breaking-down leucocytes were the source of this fibrinogen.

Loewit[1] examined the blood in the vessels, and observed an escape and separation of material from the protoplasm of the cell-body of the white blood-corpuscles in the form of fibres and granules. This he called plasmoschisis.

Lilienfeldt,[2] in an elaborate essay, observed that a substance contained in the cell-nuclei, called leuconuclein, possessed in a high degree the power of causing coagulation and the formation of fibrin. By histological experiment he demonstrated that fibres of fibrin were attached to the nuclei of leucocytes; that thereby the leucocytes tended to adhere to the vessel walls, and that certain nuclear ingredients in some manner extracted from the fibrin threads passed out of the cell-body.

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[1] Zeigler's Beiträge zür pathologische Anatomie, 1889, v, p. 471.

[2] Zeitschrift für pathologische Chemie, 1894, Bd. xx, p. 89.

Gradually the nucleus loses in a great degree its power of taking staining reagents. Lilienfeldt found that this power depended upon the presence of the nuclein substance above mentioned. Thus, when the nuclei give up their nuclein to the plasma to form fibrin they lose the power of taking stains. This phenomenon of the transit of the nuclein has been designated as karyoschisis.

Notwithstanding the apparent differences, it is well to consider the plasmoschisis of Loewit and the karyoschisis of Lilienfeldt under the same head.

Hauser[1] found, with the aid of Weigert's stain, that in the inflammatory deposits of fibrin an especially large amount of fibrin accumulated about the degenerated cells, and he called this place the "coagulation centre."

He found in the inflamed and œdematous connective tissue in the vicinity of a laryngeal diphtheria a fine-meshed fibrin net-work, in which were numerous nodular points, which looked like particles of dirt in the specimen. By the use of a stronger lens, however, it could be plainly seen that each of these blue-stained points was a collection of fibrin enclosing in its midst a connective-tissue cell or a colorless blood-corpuscle, and sending out in all directions radii of fine fibrin fibres. The cell included in the centre showed the characteristic changes of a dying cell. These pictures were clearest in those specimens in which the amount of fibrin was the least.

These experiments and observations teach that this adhesion cannot take place without the degeneration of cells. These experiments show that two peritoneal surfaces sewed together for a large area can lie together for days without reaction. This may be the case with loops of intestine sutured together, adhesion taking place only at the places of the passage of sutures. Between these places, if no damage has been done to the peritoneum, no adhesion takes place.

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[1] Deutsche Archiv für klinische Medicin, Bd. L, p. 363.

A practical application of these principles can be made use of in operations in the abdomen, in which it is desirable to diminish as much as possible the formation of adhesions. As a result of a series of experiments, it was found that all antiseptics, especially sublimate of mercury and carbolic, damage to a great degree the endothelium of the peritoneum; that thymol and boric acid do this damage in a much lesser degree than the others, and that even the dry handling of the peritoneum has a damaging effect. If the exposed peritoneum is covered with a layer of absorbent gauze so that evaporation is not prevented, and left for half an hour, there will appear upon the intestinal as well as parietal peritoneum, as a result of the disturbance in the superficial cells, a deposit of fibrin over the exposed surface. On the other hand, the cells remain unchanged if the peritoneum is kept moistened with warm salt solution.

These experiments are of practical importance, as are those of Walthard[1] upon the drying influence of the air upon the peritoneum.

Associated with its easy vulnerability the peritoneum is characterized by a great capacity for regeneration. In order for adhesions to take place, it is necessary that two damaged surfaces shall be in undisturbed contact for a considerable length of time. Some irritation of the vessels with escape of plasma into the tissues is also necessary.

Walthard showed that the action of dry air upon the peritoneum for twenty minutes, with infection, caused severe damage to the endothelial cells, and resulted in the formation of adhesions or in inflammatory thickening.

James P. Warbasse.

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[1] Korrespondenzblatt für schweizer Aerzte, 1893.

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